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GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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VOL. CLXXI., No. 3255.] WEDNESDAY, SEPTEMBER 30, 1925. [77TH YEAR.

EDITORIAL NOTES.

Cardiff Supplies an Example.

SOME of those dreamers who, without fundamental and practical knowledge, are of opinion that the best way to save coal and money is by utilizing the former for the generation of electricity, and then applying it not only to lighting, but to power and heating (so through heating prodigally wasting coal), seem to be very reluctant to examine the facts of the use of coal by the gas industry. If they would do so, they would ascertain some remarkable truths concerning the efficiency with which coal is employed by the industry, the vast amount of work already accomplished by it in the production of labour-saving and smoke-preventing fuels, as well as the provision of materials upon which the processes of other industries are founded. If this investigation were made, and thorough insight obtained into the widespread benefit of the industry, we think, if intelligence moved them, they would make a strong essay to provide every facility for enabling the good work to be extended as fast as possible. They would also find from their research that, though the industry has existed upwards of a century, its greatest developments in efficiency and service have been during the years since 1900. As a matter of fact, it is only during the past quarter of a century that the industry has begun really to live; and it is only during that period that the men of the industry have become alive to its great potentialities, and have concentrated upon their materialization to the benefit of the community. Formerly the industry was much like Hodge. It did its daily work, and did not appear very enthusiastic about it; nor had it any great ambitions. Its horizon was limited. All this has been changed. But those men who are dreaming of, and scheming for, electricity for everybody and for all light, heat, and power requirements, are ignorant of the doings of the gas industry in every community, for all industries, and nationally.

Mr. Lloyd George is a strong advocate of the State helping electricity to do those things which are incompatible with national economy, and which the very nature of its generating process renders it incompetent to do well. The Ex-Prime Minister, belonging to Wales, knows Cardiff intimately. He should study the Presidential Address of Mr. H. D. Madden to the Wales and Monmouthshire Institution of Gas Engineers (as published to-day) to see what the Gas Company serving that city have done, and are doing with increasing efficiency, in utilizing coal, and contributing to the welfare of the citizens and to that of industries—being rewarded by a dividend such as an unindulgent Parliament think equitable for the magnificent work that is achieved. But not knowing, and apparently not caring much about these things, Mr. Lloyd George has his eyes fixed upon electricity as forming the means of providing power and heat from coal—while totally ignorant of the real issues. Those who think with him, or with the present Government, should read first what Mr. Madden has to say in his address under the heading of "Subsidy," and then turn back to the beginning, and to the tale of progress in efficiency and service which, in the presidential utterances, is presented in a nutshell, but could be developed, did occasion require, into an historical volume. It is all put so modestly that probably the ordinary reader could not properly assess the past development which underlies the narrative; but the main facts are there.

For example, the President tells how at one time the Company had manufacturing stations at Grangetown, Bute Terrace, and Taffs Well; but now the manufacturing works are all situated at the first-named place. Why? Because of the economy from the beginning to the end of the processes brought about by concentration; but to concentration alone is not attributable all the economy that has been produced. A considerable part of it is due to the greater efficiency that has been developed in both plant and methods—resulting in the economical use of coal and in increased volumes of products per ton, and lower prices to the consumers compared with the days of less efficient types of plant and processes. And as the address shows, by careful supervision and chemical control, combined with systematic records day by day, and their analysis and comparison from time to time, the standards of efficiency—scientific and commercial—are maintained. The address tells, too, how, by the variety of plant that is now provided, one is able to utilize a wide range of fuels for manufacturing purposes, and to operate the plants variously according to the conditions of the markets, flights in gas demand, or emergencies. Electricity has not the same latitude; want of storage and prohibitive capital expenditure for huge stand-by plants being against it. The address is a presentment of economical progress from the beginning to the point where service to the community is touched upon, while not overlooking another advance through bringing the Company's workers into co-partnership, and making provision for healthy recreation. The extreme Socialists do not like this very practical form of Socialism. They do not approve of workmen receiving money and becoming capitalists through the interest of the industry in which they are employed looking after their welfare. Is it retaliation that causes them to talk at random about what electricity will do for the working man's wife, and to favour State aid to electricity? Apparently, according to their creed, or rather words and actions, it is wrong to do right. Be that as it may, the worker in many places in the gas industry has that which the worker in the electricity industry has not. As said, too, the community and industry are well served by gas. In Cardiff, Mr. Madden informs us, there are nearly 45,000 gas cookers in use, and some 30,000 gas-fires and wash-boilers; and industry largely patronizes gas for heat and power requirements. Through this large supersession of coal, the air of the city has been materially purified. Had it not been for the part that gas has had in lessening the smoke trouble despite the increase in our urban populations, life would hardly have been worth living in certain districts at some seasons of the year, owing to the gross pollution of the atmosphere.

Yet all this, with the still greater work which confronts the gas industry, is ignored by men who have power in the land; and they talk of the Government helping in the development of an industry which uses coal less efficiently, and an industry—important for certain applications—which cannot show the same widespread service. Mr. Madden indicates how unpractical are some of those who espouse the causes of low-temperature carbonization and Government aid to electricity. There are many electrical engineers who have stations to which the prefix "super" could be applied, and who know that no Government scheme can result in lower costs than they have

already attained, and therefore the immediate district cannot be better served—particularly in regard to price. On the contrary, it is more likely that, as areas inferior from the demand point of view are attached to the large undertakings, this will tend rather to raise than to lower the cost to the consumers now served from those stations. Be it remembered too that the large stations, and the most economical and efficient, are in those very industrial areas which the Government are so anxious to serve through the misconceptions which seem to have well established themselves in their minds. What Mr. Madden thinks of it all is found in the address, which also contains the opinion that, "being engineers first and partisans afterwards, our brethren the electrical engineers and gas engineers could, if they united their brains, do more to solve the problem of coal conservation and cheap energy production and supply than any lay-minded political body." But apparently the Government believe they know best, and are satisfied to proclaim by their actions that in the case of electricity orderly evolution, such as there has been in the gas and other industries, requires to be blocked, and something of a revolution along politically favoured lines should be applied. The Government are really proposing to act autocratically; the fact that they think it right to intervene in matters of technical policy is not a compliment to the technical leaders of the electricity industry.

The Scunthorpe Dénouement.

Around the Scunthorpe internal combustion gas-generators there has been a great deal of controversy. The paper which Mr. J. F. Simpson, M.A., B.Sc., read before the Eastern Counties Gas Managers' Association last week advances the history of the plant another stage. It was a fair presentment of experiences and issues. The details and considerations which are incorporated in the communication are, however, so extensive that it would be impossible adequately to discuss them in a brief editorial reference. A few years ago, Mr. Moore (predecessor of Mr. Simpson at Scunthorpe) read a paper before the same Association on his internal combustion generating plant; and later we had the pleasure of publishing an article by Mr. N. E. Rambush, the Chief Engineer of the Power Gas Corporation, regarding a design of generator which claimed to constitute an advance upon that which Mr. Moore had developed. Now we are faced with the fact that Mr. Simpson's experiences have led him to adopt as an extension to his gas-manufacturing plant Woodall-Duckham vertical retort settings.

The fact speaks volumes; but we should be sorry if deductions were made from it that were unjustifiable and detrimental to the internal combustion generators. In the first place, reading the remarks of Mr. Rambush in the discussion of the paper, there is traceable in them regret that the contractors for the internal combustion generators had not the opportunity of dealing with the installation in its entirety—that is to say, with the accessory plant as well as the generators—and a confidence that had they been allowed to do so, and had the plant been run continuously and not intermittently, in both efficiency and higher calorific value the results would have been of a far more acceptable order. Another consideration is that Mr. Simpson's paper deals with such a plant as the sole means of production of gas on a works; but the point should be marked that, in his opinion, the plant has an excellent field as the auxiliary of coal gas manufacturing plants in competition with blue water gas and carburetted water gas. That is confirmation of a view to which we have given expression on previous occasions—that this and similar plants should be (if preferred) accepted at the present time as an adjunct—not as the main process—in the production of gas. There is plenty of reason to be found in the present paper for this attitude, notwithstanding the testimonials which have come from quarters in which there has been experience of the supply to small districts of gas wholly from complete gasification plants, or their next-door neighbours. In one place, for example, Mr. Simpson says: "As an auxiliary unit, its value would be simply a "question of circumstances; and I have no doubt that it "could easily more than hold its own against such rivals as "blue or carburetted water-gas plant, or any other system "of internal combustion gasification short of the producer "gas method."

Apparently the greatest trouble experienced with the plant was the maintenance of the calorific value at a fairly level figure per cubic foot, without constant supervision and continual tests. In the ordinary plant routine, we are told, even 380 B.Th.U. would be difficult to maintain; but the value was ultimately declared at 375 B.Th.U. Mr. Simpson is a believer in low-grade gas. He has had experience of gas distributed as low as 300 B.Th.U.; and he is confident that a constant value of 350 B.Th.U. with few inerts would have given the old consumer better satisfaction than the complex of inerts to which he had been accustomed. But he adds that it would be idle to say the consumers as a whole were satisfied. Even with gas of 375 B.Th.U., the adjustment of certain appliances was difficult; and lighting to be a success had to be confined to medium and bijou mantles. And 375 B.Th.U. is a value that Mr. Simpson has found it almost impossible to maintain with the process. The gas has been as low as 340 and as high as 430 B.Th.U.; and, contrary to ordinarily accepted belief, he finds that if gas is sent into the holder in patches, it will come out in patches, while the maintenance of any declared value is, within certain limits, of the utmost importance. Of course, by quoting the foregoing figures, the author recognized that he laid himself open to the charge of careless operation; but in the paper he gives reasons which suffice to modify any indictment of that kind. It is considered by him that a value lower than 400 B.Th.U. should not be supplied; and with a coal gas plant and the present plant utilized as an auxiliary, and making gas at 350 B.Th.U., a mixed gas with a level calorific line could be supplied with reasonable efficiency and flexibility. Hence—combined with "the final balance-sheet, which told no uncertain tale"—the adoption of the Woodall-Duckham plant, with the internal combustion generators supplying the gas required for the reduction of the calorific value to the desired level.

Refractories Research.

The main theme of the Presidential Address which Mr. Frank West delivered at the Autumn Meeting of the Refractory Materials Section of the Ceramic Society was that of research; and the treatment of the subject was highly valuable, in that it impressed one with the immense industrial importance there is in constant and penetrating investigation into matters affecting the production and use of refractory materials of all kinds. In the first place, Mr. West alluded in terms of high appreciation to the work of the British Refractories Association during five years' existence. He did this for obvious and definite reasons We know that the Association and the research work so far accomplished have been exposed to strong criticism, which suggested an amount of dilatoriness which, in the light of facts and the knowledge of those behind the scenes, is regarded as having been somewhat unjust. The Association have had to devote a considerable amount of time to what the President terms the "spade work." But the organization has now got into working stride; and he is desirous—as we all must be—that the work of a more or less preliminary nature shall yield its harvest of benefit in due season. This, however, will be impossible if the Association are not allowed to continue their activities; and activities of the kind cannot be maintained without adequate funds. Those responsible for the work are aiming at the organization becoming self-supporting through the manufacturers and the users; but it has not yet arrived at the stage when it can claim to be in that satisfactory state. They are therefore asking for a grant from the Government for a further limited period to enable this beneficial enterprise to establish itself on a firm basis in respect of finance. In conjunction with this, a strong appeal was made by the President to both manufacturers and users of refractories to render satisfactory support to the Association, as unless this is done the Government grant will be discontinued. This would be a great pity. Despite past criticism, Mr. West was able to say that the work which has been achieved has received high praise from independent scientific experts who have lately been reviewing the operations of the Association.

With regard to research generally, at this time of day it is unnecessary to enlarge upon it as an essential in any competitive industry. But the manufacture of refractories differs markedly from other industries. For the makers of refractories there is no uniform raw material; and there-

fore the products cannot be assessed by composition, but judgment must be made through and by performance. In other words, what the individual manufacturer has to do is to take the clay at his disposal, and modify his processes according to the dictates of research in order that he may make the best use of it, and realize the finest product. Expressed otherwise, every clay has its own properties or characteristics, and therefore has to be treated in such manner that it will give the best possible account of itself whatever the destined application. This being so, it is plain that the widest scientific knowledge of a directional nature is necessary to efficiency and progress in this particular industry, which efficiency and progress affect not only the manufacturers, but the users of the materials, especially in these days when, as in the gas industry, the materials are exposed to much higher temperatures, and (in the case of retorts and supporting brickwork) have to withstand much heavier charges than obtained in the days of low temperatures and light charges. In these circumstances, the higher qualities of refractory materials which are required cost more money; but the additional initial outlay is compensated (or should be) in the augmented value realized in the materials. Were it not so, the costs of maintenance and replacements would be of such a character that it would be impossible to take advantage of the economies and efficiencies which higher temperatures and heavier weights of charges produce for the user. From this, it will be seen what a great benefit to the users of refractories is research such as the British Refractories Association have undertaken; and thus upon the users of refractories the work has a very strong claim for material support. And not only in regard to the present, but the future. Looking forward, one does not know what developments are likely to take place in connection with high-temperature work; and in view of this it is essential that the activities of the Association should be somewhat ahead of demand, in order that when developments arise—such as the provision of cheap oxygen, which may come at any time, and then be applied to metallurgical and coal-carbonizing operations—we may not have to wait an unconscionable time for the provision of refractories which will enable advantage to be taken of new discovery and progress in other directions.

We may sometimes be disposed to complain, through occasional bad experience, of the inadequacy of some of the materials which are supplied for purposes nowadays regarded as quite normal; but it would then be well to remember that we have advanced far in the matter of the application of high temperatures to coal carbonization, and that, even so, the lives of our refractory materials can be said to exceed, as a rule, those of the refractory materials which were used for carbonizing purposes in the days of much lower temperatures and lighter charges. We trust that the appeal which Mr. Frank West made will receive not only consideration, but a good response.

Internal Troubles.

THE greatest trouble that Labour has to face is of an internal order. The Communists within their borders are out for disintegrating the Trade Unions, and to bring them into subjection; and they are doing this with a perseverance which should be devoted to some more useful purpose. In fine, they are endeavouring to pave the way to revolution. The Communists are always looking for trouble; and if they cannot find it, they will use the smallest pretext for the purpose of creating it. Everything is magnified; mountains are made out of molehills. There is to-day the trouble over the interpretation of the terms of the coal truce. The miners state that they had an assurance from the Prime Minister, when the agreement was arrived at, that there would be no wages reductions before the end of next May, and that the minimum rates in existence in July would remain unaltered. On the other hand, the coal owners state that the settlement made with the Government did not revoke or suspend the operation of the 1924 agreement, under which there can be local variations and reductions of basic rates by agreement; and what the miners' leaders are trying to do is to get the agreement altered to their advantage. There is something to be said for the contention of both parties, inasmuch as the vote of £10,000,000 is officially described as "provision for a temporary subvention to enable the coalmining industry to continue the payment of wages at rates not less than those obtaining in July, 1925;" but the explanatory Memorandum alludes to the 1924 agreement as the governing basis of the subsidy. What was no doubt meant was as explained in the Memorandum; and the official description was unfortunately worded. However, the Mines Department upheld the contention of the owners; and the Prime Minister last Thursday did the same. It appears that as an alternative to the closing-down of pits in certain cases, it has been suggested that there should be a revision of the basic rates under the agreement. The miners' leaders had to confess that there had been no concerted movement in this respect, and that the whole trouble applies only to four pits. No doubt, had there been a concerted movement on the part of the owners in this direction, the Government would have seen fit to intervene. It is also stated that the men who resist accepting a change in the basic rates, if this led to the closing-down of pits, could not claim unemployment benefit. The decision of the Prime Minister that the settlement recently arrived at continues the 1924 agreement, and that any question as to unemployment benefit must be determined in the manner prescribed by Parliament, has caused the extreme leaders of the Miners' Federation to become rampant again. The Executive immediately decided to call a Delegate Conference for Oct. 9; and the Communist Secretary at once began to talk in his usual strain—threatening force through an appeal to the whole Labour Movement to stand by the miners as they did in July to see that wages were not reduced. In a speech at Newbridge (Mon.) last Sunday week, Mr. Cook said: "The fight has to come. Capitalism has "failed in the premier industry of this country. The Gov- "ernment have either to keep on the subsidy or take over "the pits." As we said in the beginning of this brief review of the further threatened disturbance in the coal industry, the greatest trouble that Labour has to face is due to the disturbing elements to which the Trade Unions have given shelter and opportunity within their own borders.

Coke Competition Awards.

The Coke Competition Awards will be published in the "JOURNAL" for Oct. 7.

Summer Time.

Summer time will end, and Greenwich mean time will be restored, at 3 a.m. (summer time) on the morning of Sunday next, Oct. 4, when the clock will be put back to 2 a.m.

Broadcasted.

Last Thursday evening, the Cardiff 5 W.A. Broadcasting Station sent out a lengthy report of the meeting of the Wales and Monmouthshire Institution of Gas Engineers (an account of which is given in this issue). The broadcasted report dealt specially with the magnitude of the gas industry; data as to coal used, &c.; also the President's case against subsidizing the electricity industry. This was done voluntarily; it will certainly assist the industry's Publicity Campaign.

Pollution of Rivers.

In an editorial article, "The Times" has recently been dealing with the question of the pollution of rivers. Generally speaking, it is a fair article; but it winds-up with the observation: "There is, for instance, no longer any doubt that washings from tarred roads damage fisheries; and since it is quite easy to use a harmless bituminous product on all surfaces that drain directly into rivers, owners of fisheries should insist that this is done. No intelligent person would wish to be unreasonable; but in many cases pollution is entirely indefensible and quite unnecessary; and the public can bring about immense improvements by uniting to exercise their legal rights." We are glad that our morning contemporary limited this statement to the "surfaces that drain directly into the rivers," because these form such a small proportion of the total length of roads on which there is treatment by tar, that the statement is not so objectionable as the view which lately became almost generally accepted, that the central authorities were advocating upon all roads the use of an imported product rather than the home-made one. But, as a matter of fact, it has been proved that, even for those roads which are in

proximity to, and which drain into, rivers containing fish life, tar can be so treated as to be rendered innocuous.

Other Sources of Contamination.

But it is ridiculous to accuse tar surfaces, as has been so commonly done, of being the sole cause of detrimental effect upon rivers. There are many sources of contamination which have probably a greater effect than tar surfaced roads. Even the petrol or other oily substances dropped by motor cars upon the surfaces of roads may contribute materially to the creation of a film upon the surfaces of rivers, which would be destructive to the food of fish and to the fish themselves. Moreover, the article in "The Times" is based upon a protest by the Dean of Durham against the contamination of rivers through the bye-products of industrial works; and it is shown how all sorts of industrial and other discharges contribute to deleterious conditions. There is sewage pollution; there is the chloride of lime that is sometimes associated with the effluents of laundries; there are the acids in industrial wastes or grease in wool washings. In fact there are a hundred-and-one causes of pollution which are readily traceable to industrial operations, and which it is very difficult to eliminate without occasioning injury to the industries themselves. But all this merely points to the fact that tar has had placed upon its back a great deal more crime than is justified by the facts.

World Power Conferences.

The second World Power Conference was the subject of discussion at a recent meeting of the International Executive Committee held in London. It was decided, subject to reconsideration, that the second Conference should be in 1930, and (accepting an invitation of the Italian Government) that it should be held in Rome, if conditions were then suitable. Meantime, with a view to keeping interest alive between the plenary Conferences, and securing general progress in the fulfilment of the objects of the World Power Conference, it has been decided to hold sectional meetings under the auspices of the International Executive Committee. The first sectional meeting will probably be held at Basle next year.

Coal Exports.

The unsatisfactory condition of the coal trade during the quarter ended June (referred to in the "JOURNAL" last week) continued in the opening months of the current half-year. In August, the total amount of business done abroad in all classes of coal is represented by 3,272,110 tons, as compared with 5,074,744 tons in August, 1924, and 6,580,410 tons in August, 1923. The values of these quantities were: August, 1925, £3,159,952; August, 1924, £5,732,629; August, 1923, £8,314,710. The falling-off of business and of values on the ton basis are of very serious moment. Of the total quantities above-mentioned, gas coal was represented last month by only 510,130 tons; in August, 1924, by 730,056 tons; and in August, 1923, by 766,935 tons. The value of the 510,130 tons shipped last month was £459,156, which averages 18s. per ton. The value of the gas coal in August, 1924, was £799,728; while in August, 1923, it was £939,662. Taking the eight months of the year, the amount of coal of all sorts sent overseas was 33,562,809 tons, of a value of £34,537,380. In the corresponding period of 1924, the quantity was 41,693,690 tons, of a value of £50,099,242. In the same months of 1923, the quantity shipped amounted to 53,156,546 tons, of a value of £67,571,441. It will be seen from these figures that the value of the coal exported in the past eight months was only a little more than half that exported in the same period of 1923. In the eight months, 4,494,150 tons of gas coal were sent overseas, of a value of £4,366,171. In the corresponding period of 1924, the quantity was 5,727,586 tons, of a value of £6,703,293; and in the same months of 1923, the quantity was 6,211,911 tons, and the value £7,568,458.

Gas Coke Shipments.

The quantity of gas coke sold to other countries last month was 96,518 tons, of a value of £91,111, which averages 18s. 10½d. per ton. In August, 1924, 105,714 tons were shipped, of a value of £186,307; and in August, 1923, 104,482 tons, of a value of £172,640. In the eight months of the year, the business in gas coke abroad amounted to 368,027 tons, of a value of £453,771. In the corresponding period of 1924, the quantity exported was 613,533 tons, and the value £1,073,766. In the same period of 1923, the quantity was 694,056 tons, of a value of £1,077,165. These figures are impressive as to the considerable diminution that has occurred in the business we do abroad in gas coke, as well as in values.

Sulphate of Ammonia.

In August, the quantity of sulphate of ammonia exported was 19,982 tons; and in August, 1924, 23,196 tons. In the eight months of the year, the shipments were 176,044 tons, as compared with 177,792 tons in the corresponding period.

Tar Products Exported.

The small quantity of benzole that is being exported is again shown by the returns for August. The quantity was no more than 1753 gallons, as compared with 76,606 gallons in August, 1924. In the eight months, the shipments amounted to 140,753 gallons, which is insignificant compared with the 1,169,866 gallons in the corresponding period of 1924. Naphtha made a slightly better showing with 4873 gallons last month, as compared with 1780 gallons in August, 1924. In the eight months, the quantity of naphtha sent abroad was 35,573 gallons, as compared with 151,290 gallons in the eight months of 1924. Combining tar, oil, creosote, &c., last month 2,537,925 gallons were shipped, compared with 5,233,363 gallons in August, 1924. In the eight months of this year, 30,398,441 gallons were exported, which is slightly superior to the corresponding eight months, when the figure was 29,258,003.

Protection for Gas Undertakings.

In the Public Health Act which received the Royal Assent last month, the National Gas Council, working in conjunction with other Public Utility Associations, secured various protective amendments. There is one section of the Act which provides that no new building, erection, or excavation shall, after an improvement line has been prescribed, be placed or made nearer to the centre line of the street than the improvement line, except with the consent of the local authority. But a proviso now appears that the prohibition shall not affect any right of statutory undertakers to make any excavation for the purpose of laying, altering, maintaining, repairing, or renewing pipes, &c. Another section empowers the local authority to purchase compulsorily any land not occupied by buildings lying between the improvement line and the boundary of the street, Here again, protection is given in regard to pipe and other work. Furthermore, none of the powers relating to the improvement line or the compulsory purchase of land is to apply to land specifically authorized by Parliament to be used for the manufacture or storage of gas, the generation of electricity, &c., unless the consent of the undertakers is obtained by the local authority. Section 80 confers upon municipal gas undertakings powers hitherto specially conferred by their Private Acts in respect of the laying of gas and water pipes in private streets. The National Gas Council point out that this new Act is to be read in conjunction with the other Public Acts so that section 308 of the Public Health Act, 1875, must be deemed to be incorporated therewith. Therefore, any gas undertakings which are injured by the exercise of any of the powers enjoyed by local authorities under this Act will be entitled to full compensation. Protection of the rights of the statutory gas undertakings was also secured in the Roads Improvement Act.

The "Hortonsphere."—The announcement is made by the "Gas Age-Record" that the Central Arizona Power and Light Company own the first "Hortonsphere" that has been built. This holder, which resembles a balloon, is 57 ft. 6 in. in diameter, and will contain 300,000 c.ft. of gas at a maximum pressure of 50 lbs. per sq. in. The principle behind this new type of holder, to which reference has already been made in the pages of the "JOURNAL," is the same as the one which is said to underly the spherical shape assumed by toy balloons, which assume a spherical shape because a sphere has a greater capacity for the same area of surface than any other body. This, it is urged, means that a spherical tank can be made to contain more gas per unit of cost than a tank of any other shape. The holder has been named the "Hortonsphere" in honour of its inventor, Mr. George T. Horton, of Chicago.

PERSONAL.

After having served for nearly thirty years as Engineer and Manager to the Ascot District Gas and Electricity Company, Mr. A. E. BROOKS has accepted a seat on the Board, in place of the late Mr. Samuel Spencer.

Dr. GEORGE CHRISTOPHER CLAYTON, C.B.E., M.P., and Prof. HENRY CORT HAROLD CARPENTER, F.R.S., have been appointed by Order of Council dated the 16th inst. to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

On the occasion of his marriage, which took place on Sept. 3, Mr. J. HUNTER RIOCH, Assistant Engineer and Manager of the Inverness Gas Department, was presented with a handsome timepiece by the staff. The chair was occupied by Mr. A. Thomson, Engineer and Manager, who, on behalf of the staff, wished Mr. Rioch every success. The presentation was made by Mr. D. Mutch, the oldest employee. Mr. M'Leod, Works Superintendent, also spoke in appreciative terms of Mr. Rioch.

ELECTRICITY SUPPLY MEMORANDA.

IT is now announced that in all probability, when Parliament reassembles, the Government will be in a position to make some pronouncement as to their decisions regarding the electricity scheme, but they are hardly likely to make any attempt to develop legislation until next year. There is no question that the Electricity Commissioners are acting as a spur in this matter to the Ministry of Transport; and the Minister of Transport is urging his colleagues in the Government to move as quickly as possible. The new power station was recently opened at Nottingham; and the Chairman of the Electricity Commissioners (Sir John Snell) seemed on the occasion to be suffering from an attack of pessimism, or something else which made him see things darkly. He stated that, unless great improvements were brought about in the supply of cheap power, this country would be seriously handicapped in competition with overseas manufacturers. Sir John Snell must have been speaking with his tongue in his cheek; if not, he can hardly be conversant with the facts. The manufacturers know well that it is not the cost of power that is oppressing and handicapping them, but other costs—rates and taxes, and labour, which cause materials and all forms of production to be fearfully dear. As a matter of fact, in the total of a works outgoings, the expense of power is relatively trifling; and as Mr. D. Milne Watson has recently pointed out, even in the north-eastern area of the country where electric power is obtainable at prices comparable with any other large industrial country, industry is as depressed and unemployment as rife as in other quarters where the cost of electric power is higher. There is a lot of nonsense talked about the efficacy of electric power in producing a revival of industry and placing our manufacturers in a stronger competitive position. There are other forms of power which can make a more economical showing than electricity according to the character of the load and the conditions of working, and Sir John Snell must be aware of this. Mr. Philip Snowden, the Chancellor of the Exchequer in the late Labour Government, is still favourable to State aid for the electricity industry. In a speech at the opening of an extension of the Keighley Electricity Station, he remarked: "We cannot hope to develop the electricity industry in this country as fully as it could (or should) be developed, without the assistance of the State." The Labour Government would have been worse than the present Government in their ideas as to State aid for the electricity industry, and for the development of the use of electrical energy for power and heating; they would have helped anybody to electricity no matter the effect upon public funds, the pockets of the consumers, and the coal resources of the country. Indeed, their knowledge of the fundamentals of the subject was even more lamentable than is that of those politicians who are in these times being led by the ears by interested parties.

The Government Scheme and Visions.

"All Electric" Equipment Hire-Purchase.

Every conceivable means of developing the domestic uses of electricity is suggested in the electrical world, and no objection can be raised to all the acumen and legitimate devices that can be applied to the expansion of business. "Electrical Merchandizing"—a paper published in America—has given birth to a new idea. It says that many forms of equipment—such as automobiles, bathrooms, and other modern conveniences—are sold to the American public by means of easy payment systems; but electrical dealers are content to dispose of a single appliance at a time. This being so, it is the view of our contemporary that complete electrical equipment will never, along that line, become the standard of the American house. The suggestion is therefore put forward that the whole of the electrical equipment in a house should be supplied at once on a hire-purchase basis, or against a mortgage. The suggestion is that installations as costly as from $1000 to $1500 should be entertained. Such installations would, of course, not be the simple equipment which is called "all-electric" in connection with housing schemes in this country, but installations such as very few people could afford to buy off-hand; and evidently the view is that more would be able to afford them if they could obtain them, as they can houses and other things, on the instalment principle of payment. If this is a good thing for electricity, it would be equally good for gas. The all-gas house with high-standard apparatus would not be nearly so costly as an all-electric house, also with high-grade equipment. That would be a point in favour of gas as compared with electricity, especially if the working expenditure for the latter was so great that it made the users too poor to meet their "easy-payment" obligations. There is one rule we should be inclined to make in connection with all-gas or all-electric equipment; and it is that it should be confined to householders who are the owners, and not merely the tenants. We do not think there is much likelihood of a big development of the all-gas or all-electric easy-payment project; although, if the security is good, we see no reason why complete high-standard equipment should not be installed any more than installing the same number of single pieces of equipment in different houses on the payment instalment plan. A large amount of capital would be involved; but again not more than would be required to place the same equipment in single pieces (as said before) in different houses on the "easy-payment" system. With good security and interest, the business would be profitable, as it would only necessitate a single account, and would ensure a large consumption through one service. Of course, the placing of single pieces of appliances on the "easy-payment" system, or on rental terms, is a good lever for further business, if there is satisfactory experience. But it is a question the several aspects of which would have to be thoroughly examined before launching a scheme.

All-Electric Houses.

We have heard much from time to time of all-electric housing schemes; but these have (with rare exceptions) only come into existence where the local authority are the owners of the electricity undertaking, supply the houses on very favourable terms, and nurse the equipment in order to relieve the tenants of as much trouble as is possible with such sensitive apparatus. An article in the "Electrical Review" by Mr. R. Hardie, of the Glasgow Corporation Electricity Department, gives an account of 290 houses which are the first completed all-electric dwellings constructed by the Corporation. He states that a further 510 similar houses have been authorized, and are at present in process of erection. Each house is furnished with electric lighting throughout, an electric cooker, a wash boiler, and provision for electric fires in all rooms, except the living-room, which is provided with an open fire. The houses are not palatial, being three, four, and five apartment ones, situated at Mount Florida and Possilpark. As a matter of fact, the three-apartment houses merely consist of a living-room and two bedrooms; the four-apartment houses comprise a living-room and three bedrooms; while the five-apartment houses contain a living-room, sitting-room, and three bedrooms. Every house has, in addition, a bathroom and a kitchenette. A 7-KW. electric cooker complete with a three-pint copper electric kettle (800 watts) is part of the equipment of each house. A cast-iron wash boiler, fitted with a 4-KW. immersion heater, is also installed. The provision for heating does not appear to be on a lavish scale. In the three-apartment houses, only one 2-KW. fire is provided; in each of the four-apartment houses, two 2-KW. fires; and in the five-apartment houses two similar fires and one of 1-KW. capacity. It is mentioned that the entire electrical equipment is provided by the Housing Authority; and there is no hire charge payable by the tenant. But, of course, somebody has to pay, and we assume that the tenants pay through the rent the charges attaching to the equipment.

The Upkeep.

Although the equipment is provided by the Housing Authority, the Electricity Department undertake the maintenance of all the heating and cooker apparatus. Who pays the Electricity Department for doing this—the Housing Authority or the tenant? Or is the cost of maintenance charged-up to the Electricity Department? If so, perhaps a portion of the item "Repairs of motors and other apparatus let for hire," which appears in the annual accounts, to which reference was made in the "Memoranda," is due to this. It was recently mentioned that the rental of motors and other apparatus let for hire by the Department amounted last financial year to only £4450, whereas, on the other side of the account, "Repairs of motors and other apparatus let for hire" reached the sum of £10,420, while the amount written off motors, cookers, and lamps (10 p.c.) was £3565. But, of course, we have no knowledge where the costs are placed referring to the upkeep of the equipment in these houses; but Mr. Hardie tells us that the cost has been found negligible, except in the case of cookers. "But with improved types of cookers, it is hoped shortly to eliminate, or at least reduce, the cost under this head." Thus

it is seen that Glasgow is experiencing the same difficulties in connection with electric cookers that have been found in other places. Another interesting point is that it is estimated that the saving effected in building construction due to the elimination of fireplaces amounts in the case of a three-apartment house to £27 10s., and in that of a four-apartment house to £34, which means that "a house to-day can be built and equipped with electrical apparatus, including the cooker and wash boiler and electric fires, as cheaply as a house without these conveniences." But we see later on that special provision has to be made for ventilation.

Charges to the Tenants. Readers will be interested in the statement which Mr. Hardie makes as to the charges to the tenants. They have the option of being charged at a flat rate of 4½d. per KW.-H. for 730 hours' use per annum of the maximum demand, which in the case of a three-apartment house is 70 KW.-H. per annum, a four-apartment house, 100 KW.-H., and a five-apartment house, 150 KW.-H.—all over this quantity being charged for at ¾d. per KW.-H. Alternatively, there is a fixed service charge per month, *plus* ½d. per KW.-H. for all energy consumed. The fixed charge for a three-apartment house is 6s. 6d.; a four-apartment house, 7s. 7d.; and a five-apartment house, 8s. 8d. per month. It is mentioned that the majority of the tenants take advantage of the latter scale; its simplicity appealing to them. The returns of the Electricity Department show that the average weekly bill for a three-apartment house is 3s.; a four-apartment house, 3s. 6d.; and a five-apartment house, 4s. 6d. In Mr. Hardie's view, "these figures confirm the fact that electrical service has nothing to fear from close comparison on the score of cost with the older methods of lighting, heating, and cooking, which it is gradually superseding." We are glad that Mr. Hardie inserted the word "gradually;" and it would have added interest to his article had he included, for comparison purposes, information as to the expansion of the heating and cooking load of the Gas Department.

Domestic Electrification Experiments. It is not, of course, all municipal authorities who can afford, like Glasgow, to take the risks of all-electric equipment in numerous houses. There are, however, a fair number of authorities who are proceeding warily by small experiments; but a very restricted experiment does not supply the diversity of conditions necessary to a definite decision. We know in connection with gas—especially in the poorer-class houses—that the extent of use to which equipment is put differs immensely, and that the care on the one hand and, on the other, the hardships to which the apparatus is subjected in respect of uncomfortable tests of its strength and of uncleanness through negligence varies in a marked way. Furthermore, in such houses pockets are not deep; and electrical heating makes enormous inroads upon their contents, if there be any. However, among the many cities and towns which are experimenting, or proposing experiment, in a small way are Leeds and York. In the former city, there is a proposal that fifty houses should be built experimentally, and furnished with electric apparatus for both lighting and heating. The Electricity Committee have had an interview with the Improvements Committee to urge this, and on the occasion they suggested that such houses would help to make for a purer atmosphere. The idea is that each house should be provided with facilities for a coke fire in the kitchen for heating water and disposing of rubbish, while all other heating, as well as the lighting, should be by electricity. The Improvements Committee have declined to come to any hasty decision, and are considering the matter. As to York, the Housing Committee have been inspecting the "all-electric" houses at Gateshead and Woolwich. Their view is that the time is hardly opportune for a complete "all-electric" scheme such as is installed at Woolwich, but they recommend to the Housing Committee a similar scheme to that at Gateshead, so as to give the tenants an opportunity of having electric lighting, cooking, and heating. At Gateshead, the Borough Council are building some 200 houses—variously four, five, and six roomed—which are being electrically equipped. The installation consists of a 3-KW. electric fire, one full-range electric cooker, one electric wash-boiler, and electric water-heating apparatus for baths and domestic use. The annual consumption is estimated at 5400 units. The hot water tanks at Gateshead are equipped with three-heat control auxiliary electric water heater, so that the tenants have the option of heating water (1) entirely from a coal-fired range, (2) entirely by electricity, (3) using electricity to augment the heating of the coal-fired boiler. The York Electrical Engineer states that his estimate for the fitting-up of the houses with electrical apparatus on the lines of the Gateshead scheme will be as follows: Installing nine lights, controlled by ten switches, and electric cooker, 3-pint kettle, 10-gallon wash-boiler, 2-KW. radiator, 3-KW. heater for fitting to hot-water supply tank, £50 per house. The Committee have agreed that four experimental houses should be fitted-up with electrical apparatus on the lines of the Gateshead scheme, and that, if possible, the Electrical Engineer should arrange for one of his men who lives on the estate to occupy one of the four houses so as to show the house and the apparatus.

A NEW PROMOTION.

"Northern Leicestershire" Project.

'We do not know the British Guarantee Investment Corporation, Ltd.; we do not like the title "Northern Leicestershire Gas Light and Coke Company, Ltd.," as applying to Ibstock and a few surrounding minor villages; and some of the statements in the prospectus show the hand of the amateur in gas matters. The high-sounding title of the Company looks so much like a bait—such as 43, Cannon Street diligently accustomed us to. However, the Guarantee Investment Corporation are, the prospectus states, authorized to receive purchases of 3000 8 p.ct. profit-sharing bonds of £10 each in the "Northern Leicestershire" Company—being the authorized issue of £30,000; the bonds ranking "in priority to the share capital of the Company both as regards security and profit." The holders of these 8 p.ct. bonds "will also participate in the profits up to a further 10 p.ct." Such terms do not appeal to the careful investor; and we know of no gas undertaking carrying on business, with a proper consideration for the interests of the consumers and for the future of the concern, which can afford to offer 8 p.ct. for capital, with the seductive suggestion attached of participating up to a further 10 p.ct. It is stated that the Company will have the advantage of "a practical" Board of Directors. We do not know the gentlemen who constitute the Board—Lt.-Col. Sir Henry Blyth Hill, Bart., D.S.O., Major Lancelot F. Orde, Henry Huth, and Lewis Bamber. Major Orde we see "was a Director for many years of the Lowestoft Water and Gas Company, and also a Director of the Great Yarmouth Gas Company—resigning to take up war service." Being a "practical" Board, it would be interesting to know whether they were responsible for the statements in the prospectus.

It seems that it is from the "Gas-Works Development and Guarantee Corporation, Ltd." (about which we should like further particulars), that the Company are acquiring the old-established freehold gas-works at Ibstock, including all the buildings, plant, stores, contracts, and the "local sales of gas, tar, and other residuals, which always command very good prices"—not "always" for they are not commanding very good prices now; and a computation later in the prospectus credits coke, tar, residuals, &c., with returning merely 5s. per ton of coal, or only 18 p.ct. of the cost of coal, which is put at 27s. 8d. To gas men this is all very humorous. We see that the present price of gas is 6s. 10d. per 1000 c.ft. That is a price which does not permit extensive development, although the writers of the prospectus are calculating on raising the consumption to 35 million c.ft. per annum. They will have something to do. The latest available returns from Ibstock show a consumption of 5 million c.ft.; a total of 300 consumers, including 160 slot consumers; and the cookers and grillers number 30! The consumption of 35 million c.ft. appears afar off. The hand of the novice is found in the opening words of the succeeding paragraph of the prospectus. It says "the erection of further retorts and retort purifiers," &c. We were under the impression that most gas plant was known to us; but "retort purifiers" have never come in our path. It is also noticed that the Consulting Engineers are Calder Anderson, Ltd.; and Mr. Edward Anderson says: "The gas-works have been well maintained, but I recommend that an additional 'gasometer' be erected." Mr. Anderson should modernize his technical expressions. It is also stated that, after the property has been acquired, there will remain £18,200, which will allow ample working capital, and provide for the further extension and development. We should imagine the balance would be adequate, and still leave a good margin in hand.

No account is given regarding the present business, financial position, and profits of the Ibstock Company; but a most picturesque statement is made by Mr. Arthur R. Choldcroft, F.C.R.A., F.I.S.A., founded on the calculation of Calder Anderson, Ltd., that the extent of area to be covered within neighbouring districts "should" result in the sale of 35 million c.ft. of gas per annum. The current price of 6s. 10d. per 1000 c.ft. is taken; and this would give from gas (assuming the attainment of the 35 million output) a revenue of £11,958. Coke, tar, and residuals at "5s. per ton" of coal carbonized would contribute £875. That is a very poor result. If only 10s. per ton were obtained for the coke available for sale from the 3500 tons of coal which hope estimates will be carbonized, it should return that sum. It should, in fact, be valuable coke, seeing that it is only expected to sell 10,000 c.ft. of gas per ton of coal used. Of course, in these calculations an allowance may have been made for an enormous leakage of gas, unless the manufacturing conditions are such that the production of gas per ton must be kept low. But it is a very poor gas yield from coal costing (for gas-making purposes) at Ibstock to-day 27s. 8d. per ton. Coal would cost £4841 13s. 4d. Purification is put down at 3d. per 1000 c.ft. (£437 10s.); repairs and maintenance, at 4d. per 1000 c.ft.(£583 6s. 8d.); repairs of meters and mains, at 3d. per 10,000 c.ft. (£437 10s.); and working expenses, salaries, &c. (all lumped together), come to £1400. The result is that the revenue is placed at £12,833 6s. 8d., and the outgoings at £7700, so that the profit is to be £5133 6s. 8d. The Consulting Engineers estimate that there

is local anxiety to have slot and other meters installed as soon as possible; and upwards of 1000 meters can be immediately fixed. The prospectus informs the reader that the price paid by the penny-in-the-slot consumer is admittedly more profitable than the ordinary rate; and therefore "the extension of the business in this particular direction will prove a most remunerative source of income to the Company, particularly as the payments are made in advance, thus eliminating all risk of bad debts." Such a statement ought not to have been made by a "practical" Board of Directors. They do not state how much more than the ordinary price of gas they intend to charge to cover the prepayment fittings installation. Inasmuch as 6s. 10d. is the price to ordinary consumers used by the Auditor in his computation, it only gives about 12 c.ft. of gas for a penny. The slot consumer would get less than that quantity for a penny. There is not much business to be done in gas among the poor at such a price.

So far as we know, every individual mentioned on the prospectus is perfectly honest; but there is not a single feature in the prospectus which would induce us to commend the "Northern Leicestershire" concern to any investor. From beginning to end, the most impressive feature of the document is ignorance of the gas business.

INSTITUTION OF PUBLIC LIGHTING ENGINEERS.

The Gas Meter Company's Display.

At the exhibition in connection with the recent meeting of the Institution in Leeds, The Gas Meter Company, Ltd., displayed on their stand various types of "The London" clock controller designed for the control of gas under various conditions. These included the standard type to light and extinguish at pre-determined times, as used in ordinary street lamps in many towns in the United Kingdom; the special iron-cased controller for use with suspension lamps; and the cluster type controller for four or more burners, which enables some of the lights to be extinguished at (say) midnight and the remainder at dawn. Special designs were shown for use in connection with staircase gas lighting of large blocks of flats and public buildings, and also for shop lighting; the latter being fitted with a special selective attachment which suspends the action of lighting and extinguishing on certain pre-determined days of the week—say, Saturday or Sunday. This controller can also be used in connection with linotype machines, and for the loading and unloading of station governors, &c.

"The London" Controller.

Important features for an ideal clock gas controller are that the operations of lighting and extinguishing should not be too long or too short—not too long because, besides the obvious waste of gas incurred thereby, there is also the danger of the burner lighting-back; and not too short because a permanent pilot is then necessary, and there is again the danger of the burner lighting-back. Too quick lighting, moreover, is liable to give a shock to the mantle. The operation of winding "The London" controller does not affect any other part of the mechanism.

An interesting booklet fully describing "The London" controller is issued by the manufacturers, The Gas Meter Company, Ltd., No. 238, Kingsland Road, London, E. 2, and contains matter of interest to all public lighting engineers.

"Principles and Practice of Industrial Distillation."—This is the title of a book written by E. Hausbrand and translated from the German by Dr. E. Howard Tripp, which has been published by Chapman & Hall, Ltd., at 21s. net.

Manchester and District Junior Gas Association.—On Saturday next the Association will visit the Bolton Corporation Gas-Works. After the inspection a general meeting will be held, at which Mr. J. T. Haynes, of Bolton, will read his presidential address, and Dr. E. W. Smith, London, will open a discussion on the production and use of coke for domestic purposes.

THE CENTRAL RESEARCH LABORATORIES OF RADIATION LIMITED.

Man is an inquisitive creature, and since the beginning of things has striven to apply the laws of Nature to his ends. The degree of civilization indicates the extent of his success. To-day science and research are the handmaids of industry, and investigations in the realm of pure science are ultimately woven into the industrial fabric. Industrial development leads to specialization demanding specialized investigation; and to-day, for progress, manufacturing concerns must carry out research in those branches of pure science which most closely touch upon their products. Even so, progress is slow, laborious, and sometimes a costly process, especially when the fundamentals of any subject are examined. It is much easier to find how a certain result may be attained than it is to determine why this result occurs, although when the why is answered, the development which follows is often so much greater. Owing to the costliness of conducting research work, in certain cases research associations have been formed for the investigation of general problems affecting particular branches of industry. The amalgamation in 1919 of the six firms constituting Radiation Limited resulted in a co-ordination of their laboratory work. The Central Laboratory organization has been in operation since then, and the extension of the activity of this branch has necessitated the equipment of a further department to centralize the research work and separate it from the more routine work of the factory laboratories. In these new Central Laboratories will be carried out investigations of a fundamental nature, which, it is hoped, will lead to that discovery of new facts necessary in certain directions before any further large developments can be made.

The initial outlay is not one which could have been undertaken lightly by any one of the constituent firms prior to the amalgamation, nor could any of these individually very well have faced the annual expenditure which such a department must of necessity involve. Though scientific control of the design and production of any product must in the course of time lead to improvement, even when research in the true sense of the word is not carried out, yet, when research is instituted and pushed to a successful conclusion, the results which accrue are noticeably greater.

We pride ourselves that this country has taken the lead in the development of gas heating appliances. The gas fire and the gas cooker owe more to this country—and history enables us to say without hesitation, especially to the firms which constitute Radiation Limited—than to any others. At no time has State or other external aid been sought to help in the development. No small part of the credit for this condition of affairs is due to the fact that the firms now comprising Radiation Limited early realized the industrial value of laboratory work. During the last twenty years the changes made in gas heating appliances may fittingly be described as revolutionary; and during this period scientific activity in the industry has been greatest.

Considering only the two principal appliances which affect vitally our food and heat, twenty years ago the gas fire was of the "ball-fuel" type, and not only was it of low efficiency, but it was unhygienic; the combustion of the gas was often poor, and the incompletely burnt products at times passed into the apartment. The modern gas fire is to-day an ideal means of heating a living room. It is not merely highly efficient, but it is thoroughly hygienic; it provides radiant heat and ventilates the apartment adequately, and yet is silent in operation. In determining its design, full consideration has been given to the findings of medical research, so as to ensure that the room shall be heated in the most suitable manner. Twenty years ago the characteristic features of the gas cooker were the drilled-ring burner, an inefficient hotplate bar, and relatively crude design of oven. Even when new, the hotplate efficiency did not exceed 25 p.ct., and after service this decreased owing to choking of the burners and consequent incomplete combustion. The consumption of individual burners was relatively high, and little attention was paid to proper flame development.

The most modern gas-cooker prototype with new boiling burner and with the flue outlet at the bottom—one of the first products of the Radiation Central Laboratory organization—is capable of doing with 1 c.ft. of gas what would have required 2 c.ft. in the older type, and with 3 c.ft. of gas the work which would have required 4 c.ft. in those appliances immediately preceding the "New World" model. These new cookers are free from those defects of the older ones which have been recognized in the light of our present standards, and the design of the ovens has permitted their operation to be made automatic and the human factor to be eliminated largely in the cooking of food. Obviously, each successive development renders further improvement more difficult and costly. Realization of the importance of discovering new facts to enable progress to be continued has played no small part in the decision taken by the Directors of Radiation Limited to equip this Central Research Laboratory, the provision of which also indicates their faith in the future of gas in its application to the home.

Of the work in hand at present it is not proposed to say

much beyond indicating the wide range of activities of the Department. It is of particular interest at the present moment, when the bogey of carbon monoxide has been raised again, to realize that means have been devised for estimating carbon monoxide, even when present only to the extent of one or two parts per million, and that all new Radiation standard appliances are tested so as to ensure that combustion shall be complete in use, and that they shall be capable of taking care of considerable overload.

The Company's well-known work in regard to measuring radiation has been extended; and not only is there determined the quantity of radiation emitted, but the quality has for some time been the subject of examination. The criticism which was advanced that the modern gas fire was too incandescent, and therefore emitted too much short wave-length energy, has been shown to have no basis of fact. The laws governing the ventilation produced by a gas fire have been determined, and it is now possible to produce an appliance giving the required amount of ventilation. Properties of refractory materials and enamelled iron ware also come under review. The composition of an enamel is complex, and the compounding to some extent empirical. Experiments have been carried out for a number of years, and are still in progress, to correlate the properties of enamels and their composition, in the hope that it may be possible to improve still further the refractory qualities of these products.

Some problems involve chemical, and some physical, investigations, while others on the border-line require the services of both the physicist and the chemist for their solution. The operation of the gas-fire burner is a typical example of the latter type, as here are involved not only questions of combustion, but, in addition, there are some difficult problems in connection with the elimination of sound and the injection of air. The physical and chemical properties of all the materials used in the construction of the different appliances made may need alteration, and equipment is provided to enable thorough mechanical and microscopic examination to be performed. The Department at present is well equipped for investigation of all problems relating to the use of town gas for heating; and if later it is found that additional apparatus is required, this will be provided.

The present development by Radiation Limited is one of great interest and advantage to the whole of the industry, and through it to the general public, besides benefiting the Company who are responsible for it. Does any householder realize that our leading manufacturers of gas appliances concern themselves with the wave-length of the rays which are emitted by their fires, and subject their goods to tests accurate to one or two parts per million? When such points as these are grasped by the general public, their confidence, not only in the gas appliance, but in the gas industry as a whole, must of necessity be enhanced.

VOLUME, WEIGHT, AND OTHER PROPERTIES OF THE THERM.

By NORTON H. HUMPHRYS.

(*Continued from p* 676.)

Table II. illustrates the combustion activities of the leading inflammable constituents, in terms of c.ft., lbs. avoirdupois, therms in volume and weight. The bulk of the therm of any inflammable gas is the reciprocal of the calorific value per c.ft. This is a simple rule for defining the bulk of any "declared value" under the 1920 Act. Considering that the staple

TABLE II.—*Gases Saturated at* 60° *Fahr.*, 30 *in. Hg.*

—	Hydrogen.	Methane.	Carbon Monoxide.	Carbon Gas.	Air, 20·6 p.ct. oxygen by bulk, 22·8 p.ct. by weight.
Formula	H_2.	CH_4.	CO.	C.	
Specific gravity, air = 1.	0·07	0·55	0·97	0·84	
Per C.Ft.					
Air for complete combustion	2·4	9·6	2·4	9·6	
Products of combustion	2·9	10·6	2·9	9·6	
Calorific value, B.Th.U.	321	992	321	912	
,, ,, per c.ft. air	134	103	134	95	
Hydrogen content.	100	80	..	..	
Per Lb.					
Weight of 1 c.ft.	0·0052	0·0422	0·0744	0·637	
C.Ft. in 1 lb.	192·4	23·6	13·5	15·7	
Air for complete combustion	34·8	17·3	2·5	11·6	
Products of combustion	35·8	18·3	3·5	12·6	
B.Th.U. per lb., air	1,771	1,353	1,766	1,264	
Calorific value	61,760	23,411	4,414	14,672	
Hydrogen content.	1,000	25	..	..	
C.Ft. per Therm.					
Bulk	311·5	100·8	311·5	110·0	
Air for complete combustion	748 0	968·0	748 0	1056·0	
Products of combustion	903·0	1069·0	903·0	105·6	
Per Lb.					
Weight	1·6	4·2	22·6	6·7	
Air for complete combustion	55·7	72·6	56·5	84 4	
Products of combustion	57·3	76·8	79·1	91·1	

materials coal, coke, and petroleum are purchased in terms of weight (the latter possibly in gallons of an agreed specific gravity), and served out for use in a similar manner, some practical importance attaches to the weight of the therm, as distinct from bulk. All other things being equal, the maximum number of therms from a given weight of material will be those that are least in weight. The hydrogen therm is about three times the bulk of the carbon therm, but only one-fourth of the weight; and the volumes and weights of the products of combustion furnish noticeable differences. The light weight of hydrogen, together with the high oxygen requirement, leads to products of combustion nearly three times the weight of those from carbon, though the bulk is substantially less. And hydrogen gives by far the lightest therm. With the exception of carbon monoxide, which is a half-burnt product of carbon, and not a "full-blown combustible," the heat-producing constituents consist of hydrocarbons or free hydrogen. There is no free carbon, for the reason above stated. Quite 90 p.ct. of the hydrocarbons consist of methane, which, on this account, is regarded as distinct from the heavy hydrocarbons. The properties of town gas will, of course, be affected by the proportion of diluents present; but taking the combustibles only, their properties will come between the limits laid down by hydrogen on the one part and carbon on the other. The heavier hydrocarbons in which more than about two atoms of each constituent are contained in one molecule are an exception as regards bulk, though not so much in weight; but, on account of the small quantity, they do not greatly influence the total result. The obvious conclusion is that the simpler the composition of a combustible, the greater the practical value.

Carbon monoxide is not a pure combustible. By volume, it is composed of equal parts of carbon and oxygen; and, by weight, three of carbon and four of oxygen. The heat-producing power is due entirely to the carbon. When completely consumed, 0·5 c.ft. of carbon monoxide should yield $\frac{912}{2} = 456$ B.Th.U.; or $\frac{3}{7}$ lb. should give $\frac{3 \times 14672}{7} = 6288$. The actual yields of 1 c.ft. and 1 lb. of carbon monoxide are only 321 and 4414 B.Th.U. respectively. The differences are due to latent heat, or heat of formation. The calorific value of the contained carbon, divided by the yield as shown by the calorimeter, is close to one-tenth of the specific gravity of carbon monoxide as compared with hydrogen. But probably this is not more than a coincidence. The practical point is that production of this compound, even by straight distillation, is attended with important loss of heat.

It is the only form in which oxygen is included among the combustible constituents. Though gas coals contain 7 to 10 p.ct. by weight (156 to 224 lbs. per ton), not more than one-fifth of that weight is passed on to the consumers. The ultimate destination of the remainder will be further noticed when dealing with the inerts.

The properties of the principal hydrocarbons concerned are set out in Table III., following the same lines as Table II. Three mixtures are appended, which will be considered in connection with the properties of town gas. By volume, they represent respectively:

A. Three parts of hydrogen, one part of methane.
B. Two parts of hydrogen, one part of methane, and one of carbon monoxide.
C. Twenty parts of hydrogen, one part of benzene.

The hydrocarbons vary widely in volume, increasing in weight as the hydrogen content falls or the valency rises. The calorific value per c.ft. ranges from 1452 to 5890, but the position is altered when the comparison is made by equal weight. The value per therm comes within the limits of 4·6 and 5·9 lbs., and the lighter members have the advantage, as might be expected, seeing that the hydrogen therm is four times lighter than the carbon therm.

The lighter compounds are fairly stable under ordinary atmospheric conditions, but, as the weight increases, the vapour elasticity and saturation point fall, so that not more than a very small proportion is practicable. They come under the description of "vapours," by which we understand substances having elasticity of only a few inches on the barometer, and therefore being liable to precipitation as liquids on very slight reduction of temperature. Naphthalene is highest on the list of calorific values per c.ft., but is difficult to distribute, because it does not exist in the liquid form, but passes direct to a bulky crystalline solid. Some suppose that it may change to this condition by friction alone, as experienced at a right-angle tee or bend on the line of travel, without alteration of temperature. De-

TABLE III.—*The Heavy Hydrocarbons, Saturated at 60° Fahr., 30 in. Hg.*

—	Ethane.	Ethylene.	Propylene.	Acetylene.	Benzene.	Toluene.	Naphthalene.	A.	B.	C.
Formula	C_2H_6.	C_2H_4.	C_3H_6.	C_2H_2.	C_6H_6.	C_7H_8.	$C_{10}H_8$			
Specific gravity (air = 1)	1·04	0·97	1·46	0·90	2·77	3·27	4·45	0·19	0·41	0·20
Weight of 1 c.ft., lbs.	0·0801	0·0744	0·111	0·068	0·213	0·250	0·343	0·014	0·031	0·015
Bulk of 1 lb., c.ft.	12·4	13·5	9·0	14·7	4·7	4·0	2·9	71·4	32·2	66·6
Per C.Ft.										
Air for complete combustion	16·8	14·4	21·6	12·0	36·0	43·2	57·6	4·2	4·2	4·0
Products of complete combustion	18·3	15·4	23·1	12·5	37·5	45·2	60·6	4·8	4·8	4·6
Calorific value, B.Th.U.	1,730	1,578	2,301	1,452	3,738	4,488	5,890	489	489	484
Calorific value per c.ft., air	103	110	107	121	104	104	102	117	117	121
Hydrogen, p.ct.	0·75	0·67	0·67	0·50	0·50	0·53	0·44	0·95	0·70	0·98
Per Lb.										
Air for complete combustion	16·0	15·0	14·8	13·4	12·9	13·1	12·7	22·7	22·7	20·1
Products of complete combustion	17·0	16·0	15·8	14·4	13·9	14·1	13·7	23·7	23·7	21·1
Calorific value, B.Th.U.	21,452	21,776	20,709	21,344	17,568	17,952	17,081	34,963	15,766	32,234
Calorific value, per lb. air	1,340	1,450	1,381	1,600	1,361	1,366	1,345	1567	718	1613
Per Therm, C.Ft.										
Volume	57·8	63·4	43·4	69·0	26·7	22·3	17·0	204·5	204·5	206·6
Air for complete combustion	971·0	913·0	935·0	828·0	961·2	963·4	979·0	859·0	859·0	826
Products of complete combustion	1058·0	976·4	1022·0	862·0	1001·0	1027·0	1020·0	985·0	985·0	1032
Per Therm, Lbs.										
Weight	4·7	4·6	4·8	4·7	5·7	5·5	5·9	2·9	6·3	3·1
Air for complete combustion	75·9	69·0	72·5	63·4	73·5	74·2	44·0	63·8	63·8	56·3
Products of complete combustion	80·6	73·6	77·3	68·1	79·2	79·7	79·9	66·9	70·1	59·4

posits in mains or services can only be removed by mechanical means or by solvents—preferably the latter, if sufficiently reliable to carry to the burners, where its energy can be utilized. One c.ft. of naphthalene contains nearly as much heat-producing energy as 20 c.ft. of hydrogen. But its great weight—4½ times that of air—together with the other objections, secure preference for complete removal at the gas-works. The conditions that cause deposition of water and other unstables facilitate the separation of naphthalene; and gases over 600 B.Th.U. in value may contain sufficient heavy hydrocarbons to carry forward the naphthalene, or, if it is deposited, to dissolve and carry the crystals in liquid form to the nearest drip box.

No doubt the increased security against deposits in mains and services is a recommendation for gases not exceeding 500 B.Th.U. per c.ft., as they will not throw-down anything of an oily or tarry nature if exposed to reduction of temperature. On the other hand, the diminution of hydrocarbons can be carried too far.

I have not met with a complete item analysis of this class of constituents, but the specific gravity and calorific value of the whole, which are the points that specially appeal to gas engineers, can be indirectly calculated (1) by the difference in the hydrogen and carbon monoxide contents as ascertained by exploding a sample after treatment with the usual absorbents, and one from which the hydrocarbons and carbon monoxide have not been removed; (2) tables stating the percentage composition, the observed specific gravity, and calorific values of many samples of gas have been included in reports issued by the Fuel Research Board, the Gas Investigation Committee of the Institution of Gas Engineers, and other authorities, which afford data for indirect calculation by difference.

Dr. Percy E. Frankland published a table showing the composition of gas as supplied in twenty principal towns during 1882, including carbon and hydrogen densities; but carbonizing conditions, and for that matter the quality of coal obtainable, were so different from those now obtaining, that his figures do not tell much about gas as supplied in 1925. A noticeable feature is that the average densities of the hydrocarbons were $C_{2\cdot7}$ and $H_{4\cdot8}$, or in ratio of less than 1 : 2—a condition that finds no place in the methane, ethylene, or benzene series.

Some examples of the second method are shown in Tables IV. and V. The former represents mixtures obtained by adding various proportions of air (2 to 4), nitrogen (5 to 8), and blue water gas (9 to 19). The calorific values in Tables IV. and the first part of V. do not differ greatly from the results published by Mr. H. J. Coste in 1911. But Mr. West's results are 20 p.ct. higher.

High-temperature and low-temperature hydrocarbons are sometimes spoken of as being separate and distinct; but so long as the gas outlet is situated at the coldest part of the retort, there can be no sharp dividing line. In horizontal retorts, the front part of a new charge is chilled by the heat-conducting power of the mouthpiece; and the centre or inside part remains black for some hours. Illustrations of continuous vertical retorts in use show an inverted black cone extending from full section area at the top to a point nearly 20 ft. lower. There is a continuous but slow travel, fresh coal entering and passing downward at the rate of less than 3 ft. per hour. If the intermittent system of charging is used, the conditions are the same as in the horizontal type, with the exception that the retort is full, without a clear space from end to end. In all patterns at present operated in gas-works, a considerable part of the tar that goes forward to the tar well, and the hydrocarbons that are retained in the gas, escape exposure to a temperature greater than that known as "low." The higher the working temperature of the setting, the quicker the rise in that of the incoming coal, and, therefore, the smaller the proportion of low-temperature products. Hence the general experience that smaller

TABLE IV.—*Specific Gravity and Calorific Value of Hydrocarbons*

Third Report of the Gas Investigation Committee, Institution of Gas Engineers—Transactions 1919-20, p. 214.

—	Observed Sp. Gr.	Sp. Gr. H_xC_x by Difference.	Weight H_xC_x per C.Ft.	Observed C.V.	C.V. H_xC_x by Difference.
(1)	(2)	(3)	(4)	(5)	(6)
1	0·416	..	..	622	2550
2	0·548	1·42	0·108	514	2708
3	0·513	1·34	0·102	489	2528
4	0·658	..	..	353	2550
5	0·574	1·38	0·105	434	2640
6	0·620	1·21	0·092	395	2535
7	0·633	1·44	0·110	360	2410
8	0·699	1·51	0·115	295	2210
9	0·463	1·47	0·112	562	2590
10	0·452	1·22	0·093	549	2723
11	0·481	1·35	0·103	510	2491
12	0·508	1·33	0·101	468	2650
13	0·514	1·41	1·107	437	2151
14	0·532	1·59	1·210	407	2112
15	0·524	1·89	1·440	392	2102
16	0·528	1·97	1·500	370	1682
17	0·543	1·96	1·492	366	1799
18	0·543	..	..	351	1440
19	0·545	..	..	318	..
Average of	1 to 12	1·37	0·104	..	2549
" "	13 to 19	1·76	1·35	..	1881

TABLE V.—*Calorific Value of Heavy Hydrocarbons.*

—	Report on Steaming in Vertical Retorts—H.M. Fuel Research Board. Transactions Institution of Gas Engineers, 1920-21, p. 396.			Mr. John West, Transactions District Gas Associations, 1917, p. 439. High-Temperature Verticals.	
	Observed C.V.	C.V. H_xC_x.	Steam, P.Ct. of Coal Used.	Observed C.V.	C.V. H_xC_x.
A	510	2710	..	..	..
B	518	..	5·24	441	2770
C	463	2200	20·95	556	3450
D	544	2507	..	505	3512
E	517	2900	5·66	506	3637
F	477	..	12·44	522	2190
G	460	3144	20·53	494	3500
H	432	3000	30·05		
J	518	1951	..	Average	3176
K	431	1829	22·05		
1*	544	2677	..		
2*	482	2442	13·3		
3*	447	2560	22·1		
4*	436	3047	32·7		
5*	410	3230	44·8		
	Average	2631			

*Fourth Report Gas Investigation Committee. Transactions Institution of Gas Engineers 1919-20, p. 324.

yields and altered composition of the tar will follow an increase of furnace temperature. A higher temperature also induces a more rapid travel of the gas towards the outlet, and steaming exercises a similar effect, with the result that the whole of the products have a shorter time exposure to the influences known as "secondary"—the breaking up of "primary" products by exposure to heat and contact with incandescent coke. Conservation of hydrocarbons is thus favoured, which may explain the fact that, if high carbonizing temperatures mean a smaller volume, the quality may be improved. See Mr. West's results in Table V.

The practical objections to the cold off-take of gas have been recognized by gas engineers since the time when a method was introduced at a London gas-works, where double-length retorts were in use, of charging each half alternately at equal intervals, and arranging to vary the gas off-take in like manner, so that the make was always taken off at the end opposite to that which had received the most recent charge. By this means the whole of the gas passed over a minimum length of about 9 ft. at full working temperature, and at the same time increased the rate of travel by mixing with gas from the older charge. The late Mr. A. F. Browne proposed carrying the gas off-take about half way down a vertical retort, so that the production was removed at a hot centre rather than at a cold end. Various other proposals have been brought forward with the same purpose in view—such as taking-off the gas from the back, instead of the front, end of a horizontal retort; or carrying a conduit down one side of a vertical retort, with communicating openings at suitable intervals. None of these schemes has been generally adopted, and nearly all the gas made in the United Kingdom passes off at the cold end.

(*To be concluded.*)

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

HALF-YEARLY MEETING AT STAMFORD.

IN the ancient borough of Stamford, amid architectural features of unsurpassed beauty and historic associations of equal claim to notice, and favoured weather conditions which left nothing whatever to be desired, a large number of gas engineers from the Eastern Counties spent Wednesday and Thursday of last week. Business and pleasure were well combined, and the meeting was unanimously agreed to have been in every way a success. During the earlier part of the proceedings the chair was occupied by Mr. F. A. WEST of Newark (the outgoing President), and acknowledgment was made of the fact that the happy idea of meeting again in Stamford—which town the Association had not visited for many years—originated with him.

The business meeting was not until Wednesday afternoon, but in the morning a number of members visited the works of the Stamford Gas Company, where they were received by Mr. H. Green, the Engineer, Manager, and Secretary. Here they found a well-equipped and carefully kept works, beautifully situated upon the banks of the River Welland. Stamford lives largely in the past, but it is gratifying to find that its gas consumption is increasing. The borough has enjoyed for a century now the manifold advantages of a gas supply; and the Company enjoy the prosperity which is the merited reward of a public service well rendered. At the present time the annual output of gas is about 58 million c.ft.

STAMFORD GAS COMPANY'S HEARTY WELCOME.

At the invitation of the Chairman and Directors of the Stamford Gas and Coke Company, members of the Association and friends to the number of over fifty sat down to luncheon in "Ye Olde Barne"—which, like so much of Stamford, is reminiscent of bygone days, though possessing a cuisine on the best and most modern lines. Unfortunately, the Chairman of the Gas Company (Mr. James Ringham) was prevented by illness from being present; but his place was admirably filled by Mr. Richard March (the Vice-Chairman), who was supported by Messrs. E. Dalton, G. E. Higgs, and C. Dalton (Directors), and Mr. Green. The Mayor of Stamford (Mr. H. Kelham) was also present.

In extending a cordial welcome to the visitors, Mr. March pointed out that Stamford is one of the most ancient and historic towns in the country. The first Act of Parliament dealing with the manufacture of gas for the town was passed in 1823. The building of the works was begun in the following year, and lighting by gas was started in April, 1825. Those of them who knew anything of Stamford would, he said, be aware that the borough had not greatly increased in population. At the time of the last census the population was near upon 10,000, and it never had exceeded this figure. The gas-works were fully capable of supplying all the needs of the town. He expressed the hope—which was destined to be amply fulfilled—that the visitors would leave Stamford with many happy memories of their stay.

On behalf of the Association, the President thanked the Chairman and Directors of the Gas Company for their hospitality. It was, he remarked, a particular pleasure for him to do so, as his (Mr. West's) association with the gas industry could be said to have commenced at Stamford, in the time when his father was Engineer and Manager there. Stamford was a very fine town, of great antiquity; and it was many years since the Association visited it. He believed on that occasion Mr. Harry Ruggles's father was President; and it was interesting to note that there were present many other sons of fathers who in those days formed the Eastern Counties Gas Managers' Association—history thus repeating itself. He proposed "Continued prosperity to the Stamford Gas Company, and long life and good health to all the Directors."

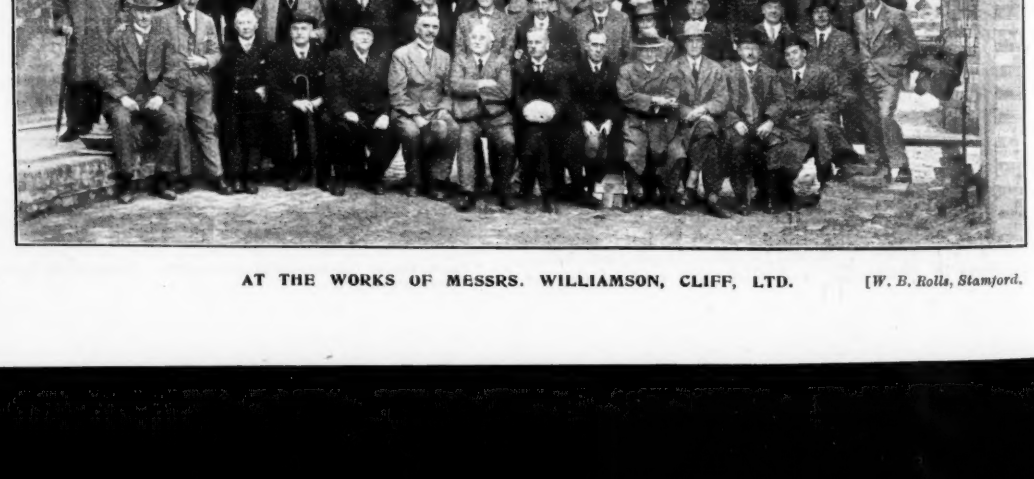
With the toast was coupled the name of Mr. E. Dalton, who, in the course of his response, congratulated Mr. West upon the position he now holds in the gas industry.

BUSINESS MEETING.

The members then betook themselves to the Town Hall, which the Mayor had kindly placed at the disposal of the Association. After the meeting had been called to order by Mr. F. A. WEST,

MAYORAL GREETINGS.

Mr. H. KELHAM said that it gave him very great pleasure indeed, as Mayor of the borough, to welcome the Association to Stamford. It would no doubt have been more fitting if the ex-Mayor, Alderman Cliff, had been Mayor on this occasion,



AT THE WORKS OF MESSRS. WILLIAMSON, CLIFF, LTD. [*W. B. Rolls, Stamford.*

because of his closer connection with the gas industry. The relations between the Corporation and the Gas Company had always been of a friendly character.

Mr. WEST thanked the Mayor for his welcome and hospitality.

MINUTES OF LAST MEETING.

The minutes of the last meeting were taken as read, and confirmed.

WORK OF THE BRITISH COMMERCIAL GAS ASSOCIATION.

Mr. WEST then called upon Mr. Mason to address the meeting.

Mr. W. M. MASON (the Manager of the "B.C.G.A.")—who was present on the invitation of the President and Secretary, to give members further information regarding the special autumn advertising campaign—as a preliminary furnished important details as to the general policy and work of the "B.C.G.A.," indicating how steady, educative advertising in papers which covered practically the whole reading public of the country was influencing public opinion in favour of gas. He showed that, just as expenditure was essential if the works were to be maintained in an efficient manner, so it was necessary to spend money to make money. Reference was made by him to some important new business resulting from inquiries received, although he was careful to maintain that advertising was only part of a service. Reasonable price, wise local policy, good showrooms, and other essentials were also needed. More money, he said, could profitably be spent in defending the industry by the best possible means—viz., pushing and consolidating its business. American public utilities spent at least 2 p.ct. of their turnover in various forms of advertising. The big London stores allocated from 2 to 10 p.ct. of turnover to advertising; while the gas industry, menaced by competition that was growing keener and keener, and with enormous and widespread interests at stake, was content to spend about one-tenth of 1 p.ct. in this way. This figure was based on an average price of gas of 4s. per 1000 c.ft., which equalled £200 per million. Now, 1 p.ct. of this would be £2 per million, against the "B.C.G.A." present subscription of 3s. 4d., or one-twelfth of 1 p.ct. Mr. Mason then gave important information regarding the urgent need for the special autumn campaign, the splendid financial response that had already been forthcoming, and the necessity for every undertaking pulling its full weight in the movement.

Mr. WEST said they were much obliged to Mr. Mason for his remarks. It was obvious that it was up to all of them to do everything they could to assist the "B.C.G.A."—not only by way of subscriptions, but by each one doing his own little bit in his particular town.

THE LATE MR. E. J. BROCKWAY.

The HON. SECRETARY (Mr. W. H. Mainwaring, of Lincoln) announced the receipt of a letter from Mr. F. G. Brockway (Engineer and Secretary of the Cleethorpes Gas Company) thanking him for a letter of condolence and sympathy which he had addressed to the relatives as soon as he learned of the death of Mr. E. J. Brockway, who was one of those who took part in the formation of the Association. Unfortunately, he did not hear of the sad event until it was too late to send a wreath or to attend the funeral.

Mr. WEST said the members all much regretted the death of Mr. Brockway; and though it was rather late now, they would wish to pass a vote of condolence with the family.

The members signified their concurrence by rising in their places.

NEW MEMBERS.

The following new members were added to the roll.

Ordinary Members.

Mr. Fred Garrett Brockway, Engineer, Manager, and Secretary, Gas-Works, Cleethorpes.

Mr. George Stevenson, Engineer and Secretary, Gas-Works, Long Eaton.

Associate Member.

Mr. John Cecil Baines, Works Assistant, Harwich Gas and Coke Company, Ltd.

They were elected on the proposition of Mr. J. W. ACCHTERLONIE (Cambridge), seconded by Mr. J. B. HANSFORD (Bedford).

THE NEW PRESIDENT.

Mr. WEST remarked that the time had now arrived for him to vacate the chair; but before doing so, he would like to thank the members for the way in which they had supported him during his year of office, the Committee for their kind help, and particularly Mr. Mainwaring for his counsel and assistance. His next duty was the very pleasant one of inducting Mr. Prentice into the chair. It needed no words of his to introduce to them Mr. Prentice, who was a gentleman so well known in the gas industry that the Association were very fortunate in having him as President. He trusted Mr. Prentice's year of office would be as happy as his own had been.

Mr. F. PRENTICE (Ipswich), who was loudly applauded, thanked the members for the honour they had done him in electing him as their President, and then proceeded to thank Mr. West for his services during his year of office, and to present him with the Past-President's Medal. He said he regarded Mr. West as one of the coming men of the industry. What he did was well done.

Mr. WEST briefly returned thanks.

RECENT DEVELOPMENTS AT SCUNTHORPE.

The PRESIDENT said they had already had papers on the work done at Scunthorpe by Mr. Moore; and the subsequent results obtained with the plant then described, together with other interesting matters, would now be dealt with by Mr. J. F. Simpson, upon whom he would call for his paper entitled "Recent Developments at Scunthorpe."

The paper, and a report of the discussion, will be found on pp. 908-13. At its conclusion,

The PRESIDENT proposed a vote of thanks to the author, remarking that it seemed to him, making a general statement, Mr. Simpson had suffered from two things. One was that his output had not been sufficiently large to do justice to the plant, and the other was that he had been limited to a single holder. Both these things made it difficult to work such a plant and to carry out the tests.

Mr. THOMAS GLOVER (Norwich), who seconded, expressed his admiration of the candid manner in which information had been set forth in the paper. What should be aimed at was a plant that would give a decent gas of constant quality. It was vitally important that they should consider the consumers first when they set out to instal new plant, and put in such apparatus as could be relied upon to give good results.

PLACE OF NEXT MEETING.

The PRESIDENT said he hoped the members would honour him by visiting Ipswich for the spring meeting; and the invitation was cordially accepted.

CONCLUDING BUSINESS.

On the proposition of Mr. W. W. TOWNSEND (Colchester), seconded by Mr. L. BIRCHMORE (Louth), the retiring members of the Committee (Messrs. J. W. Auchterlonie and J. B. Hansford) were heartily thanked for their services.

Mr. GLOVER suggested that the subject of governors should have a little more attention, and that the Secretary should approach Col. Peebles to endeavour to get him to read a paper.

Mr. R. G. SHADBOLT (Birmingham) supported this suggestion.

The PRESIDENT voiced the pleasure of the members at having among them Mr. H. Wimhurst, who was the original Secretary of the Association, and as long ago as 1888 called the first meeting. Another thing he would like to say was that much of the success of the meeting was due to the great help given by Mr. Green. They were very much obliged to him for all that he had done.

At the close of the meeting, the Mayor and Mayoress invited the members to take tea with them in the Town Hall, after which there was an inspection of the insignia of Stamford, which date back several centuries.

Later in the evening there was an informal dinner at the Stamford Hotel, a feature of which was the excellent musical programme, prepared at very short notice.

WORKS OF WILLIAMSON, CLIFF, LTD.

On the following day, which was gloriously fine, those who were able to remain in Stamford overnight—and they constituted the great majority of those who had attended Wednesday's meeting—were the guests of Messrs. Williamson, Cliff, Ltd., and found an admirable host in Alderman Albert Cliff, J.P., the Chairman (who has for many years been an associate member of the Eastern Counties Association), who was ably supported by his co-Directors, Mr. W. L. Jackson and Mr. P. K. Banks. Mr. Cliff had, indeed, already given evidence of his desire to do all that was possible to make the stay in Stamford pleasant, by taking the visitors round the town on the previous evening and pointing out to them the principal objects of historical and architectural interest. This no one could have been better qualified to do; for he knows all there is to be known (and it is a great deal) about Stamford, of which he has three times been Mayor —"a faithful friend and a good townsman," as another of the Aldermen described him in the course of the proceedings. In addition to being an Alderman of the Royal and Ancient Borough of Stamford, Mr. Cliff is a member of the County Council, and is associated with practically all the institutions of the district.

Early in the morning motors proceeded to the various hotels, to convey the members to the gas retort and firebrick works of Messrs. Williamson, Cliff, just outside the town. Here they were received by Mr. Cliff and the Directors already named, who showed them the various processes of manufacture of gas retorts and other fireclay products. It was a highly instructive tour; for in addition to the working processes and the raw materials and finished goods that were laid out for their inspection, Mr. Cliff gave his visitors much practical information on the matter of retorts. This is a subject of which he has had vast experience, seeing that he has been forty years connected with the trade, and became Managing-Director of the firm in the early part of 1909, at which time the works were reconstructed. As a matter of fact, a knowledge of materials for gas-works use, and especially retorts, may be said to have been inherited by Mr. Cliff, as his father for a long period of time contracted for the manufacture of very large quantities of these goods. Since the present Chairman undertook the Managing-

Directorship, retorts have been produced at the Stamford works which are reported to have given a life of more than nine years in constant work.

Even so, judging from the "atmosphere" of the works and all that is to be seen there, the firm are not likely to be content to "rest on their oars." In his remarks upon retorts, Mr. Cliff made it abundantly clear that he, and those who are associated with him, are constantly planning and investigating with the object of improving retort efficiency and life. Raw materials, both common and uncommon, were set out in profusion, and retort sections there were of all kinds and shapes—including some with corrugated bottoms (one or more corrugations) and carborundum base tiles, and at any rate one with zirconia. The zirconia, Mr. Cliff pointed out, was not a very good conductor. The carborundum, on the other hand, would give theoretically five or six times quicker conductivity than silica. This invention aims at the "speeding-up" of the process of gas making. Alluding to built-up retorts, Mr. Cliff expressed his preference for narrow top bricks, as forming the most elastic arch. There is clearly no "wait-and-see" policy at these works; no sitting still and remaining satisfied with present performances and methods.

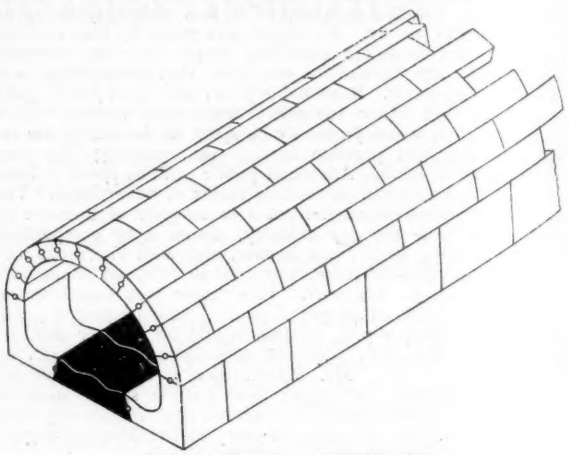
2000 Feet of Retort a Week.

For the time of year, the works were found to have a lot of orders in hand; and the members had ample opportunity of assuring themselves of the care taken in every process. Everything is designed for the turning-out of the best quality work; and the employees are able to do their part in the execution of such work, for a good feature is the large proportion of men who are able to point to a long period of service with the firm. An outstanding example of the care exercised is provided by the remarkable process of mixing the clays, which is carried out right through 100 yards of travel, in such a way that the granular formation of the clay remains unimpaired. The works have an all-out capacity of from 8,000,000 to 10,000,000 refractory bricks per annum; and there is plant which affords them the means of making in any given week 2000 ft. of retort. The moulding of retorts under heavy pressure, up to 11 ft. in single pieces, was watched with keen interest; and thereafter the party repaired to the works yard for a group photograph.

Mr. Albert Cliff on Refractory Materials Research.

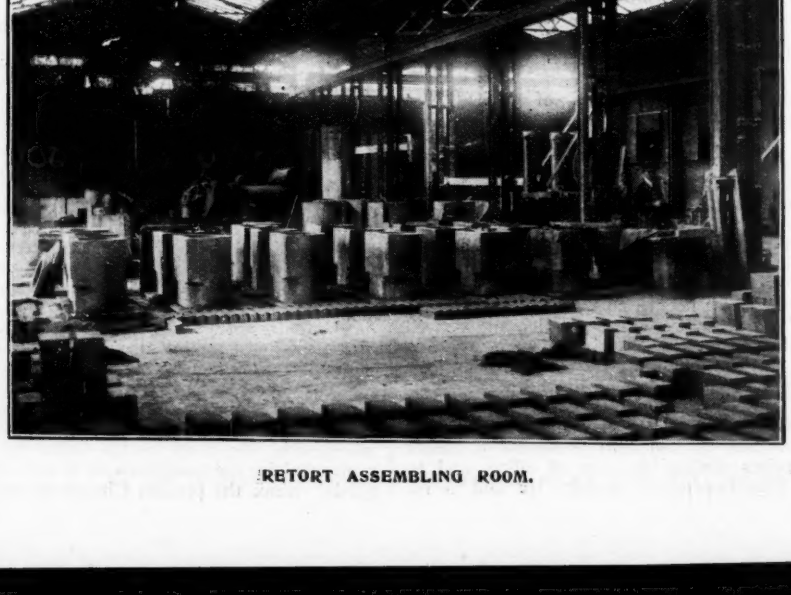
The motors were requisitioned to take members and friends to "Ye Olde Barne," where they were the guests at luncheon of Mr. Cliff, who occupied the chair. Alderman Bell expressed regret at the enforced absence of the Mayor, and offered the Association this sound advice: "Do not depend too much upon the Government." He added that he was proud to have been many years a member of the Corporation, and also proud of being the friend of their Chairman—a faithful friend and a good townsman.

In extending to the visitors a hearty welcome, Mr. Cliff pointed out that the suggestion that the Association should meet in Stamford had its origin in the fertile brain of the retiring President, Mr. West. The firm's processes were so slow, and needed so much unremitting care, that they would have been glad of longer notice; and yet if there had been that morning anything of interest, anything informing or educative, the firm had adequate compensation. They were glad the Association had been able to honour them. They were not competent in this complex world for everything; but there was one thing in which he trusted they might always excel in this ancient Municipality—in the warmth of their welcome to associations of this character. It was in 1909 when Stamford and his firm were last favoured by a visit from the Eastern Counties Association; and while it was not always convenient or wise to be too retrospective, it was not possible to forget that many of the gentlemen who were on the former occasion with them had long since passed over to the other side—Mr. West's father; Mr. Carpenter, of Yarmouth; Mr. Davis, of Gravesend; Mr. Carter, of Lincoln; Mr. Kent; Mr. Fenwick; Mr. Davis, of the Luton Foundries; Mr. Main; and Mr. Sugden. There were also others, and for all of them they had had a great personal liking. They were all distinguished by great concern for the welfare of the gas industry and the Association. At that time any really expert knowledge of refractory materials was entirely wrapped-up in the brains of the few. He was in frequent contact with several of them as a lad. No doubt they were well informed in the sense that the Mediæval Alchemists were well informed; and yet he thought it was true to say that there had been more progress in the manufacture of refractory materials over the last twelve or fifteen years than in any previous hundred years—greater progress in spite of the very rough, unparalleled storms of the period. The



Retort with Carborundum Base Tile.

gas industry had much to do with it. They knew the story, the gas engineers who led the van. Eminent chemists had also had much to do with it; and he would be a bold man who dared to suggest that there had been a more eminent worker in the whole region of silica, chemistry, and related manufactures, than Dr. Mellor. It might be that there was not a more eminent worker in this or any other country. He (Mr. Cliff) had had a long official connection with the Stoke Laboratories, and had been privileged to be in close and intimate touch with Dr. Mellor's work for years. He had been associated with him since 1909 on the Refractory Materials Committee founded by the Institution of Gas Engineers. The work was done at the Stoke Laboratories. At the present time the British Refractory Research Association were spending £5000 or £6000 per annum on this research at Stoke—work most generously supported by the Gas Executive in London. And as things were and had been, they at Stamford looked to Dr. Mellor and the strong body of able men who composed his staff for such tests or such research help as they needed. It was right and proper, that those who were engaged in the manufacture of these goods

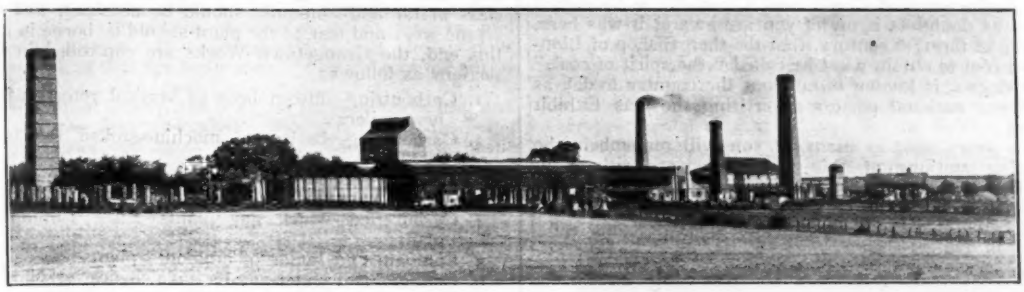


RETORT ASSEMBLING ROOM.

should be able to carry out generally physical and chemical tests, which they did; but this was not enough. Some system of first-class laboratory control and guidance must be aimed at, and was essential. At any rate, in their location they elected to employ the very fine and expensively equipped Stoke Laboratories as their centre for anything they required. The firm were closely affiliated with a Mineral Company dealing in all classes of minerals, rare earths, and the widely differing grades of material they needed. They made-up domestic and foreign clays, and had occasional shipments. They had also a stream coming in by rail; and he thought that if Mr. Jackson heard of a better clay for any given purpose in Timbuctoo, he would either go for it or negotiate to secure it, if it could be done. Life was a sort of relay race; but happily there were younger men who, when others had "done their bit," would carry things forward, and perhaps build better. In conclusion, he said that he had that morning received a letter from Dr. Mellor deploring his inability to join them.

Before leaving the tables, the President made graceful allusion to the indebtedness of the guests to Mr. Cliff, and said all would carry away with them from Stamford exceedingly pleasant memories of all that had happened while they had been there. They had been much struck by the magnitude of Mr. Cliff's works, by the care which was exercised in the manufacture of the various products, and by the general arrangements. They had had the privilege of seeing there the most up-to-date methods of making retorts—and beautifully made they were.

The kindness of Mr. Cliff did not end here, for after lunch the motors were in waiting to convey the party to Burghley House and Park, the palatial seat of the Marquess of Exeter, by whose permission they enjoyed the special privilege of walking through the gardens. Burghley Park is over 7 miles in circumference, and the house was erected by the great Lord Burghley, Lord High Treasurer of England, towards the end of the sixteenth century.



THE RETORT AND FIRECLAY WORKS AT STAMFORD.

WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS AND MANAGERS.

GENERAL MEETING AT CARDIFF.

CARDIFF was the venue of the Autumn General Meeting of the Institution last Thursday. This was appropriate in more than one sense. Mr. H. D. MADDEN, the new President, is the Engineer and Manager of the Cardiff Gas Light and Coke Company, who produce one-third of the total quantity of gas sold in Wales, and, naturally, an interesting part of the programme was the visit to the Company's works. Another outstanding feature was the able and thought-provoking address of Mr. Madden, who occupies now the position of President for the second time. For the meeting, the members and visitors were the guests of the Chairman (Mr. C. E. Dovey, J.P.) and Directors of the Cardiff Gas Company, who entertained the party to luncheon at the Park Hotel and tea at the Grangetown Works.

The business meeting was held in the Lecture Hall of the South Wales Institute of Engineers; and at the outset of the proceedings the chair was occupied by the outgoing President, Mr. W. H. JOHNS, of Swansea.

INSTITUTION AND VISITORS WELCOMED.

Mr. JOHNS, on behalf of the Institution, extended a welcome to the visitors, who included Mr. C. F. Botley, the President of the Institution of Gas Engineers; Mr. W. Doig Gibb, and Mr. F. W. Goodenough.

Mr. C. E. DOVEY, on behalf of the Cardiff Gas Company, extended a hearty welcome to the Institution. The visit, he said, was particularly pleasing to himself and his co-Directors, as the Company's esteemed Engineer and Manager had been elected President for the second time—a compliment which gave the Directors very great pleasure—and he was sure that under the guidance of Mr. Madden their deliberations would be productive of good results. In Cardiff they had made a supreme effort to show the value of gas; and he believed that, having seen their works and what they had done, those present would agree that these efforts had met with a considerable measure of success.

MINUTES OF THE LAST MEETING.

The HON. SECRETARY (Mr. Octavius Thomas, of Pentre) read the minutes of the last meeting, and they were confirmed.

ADDITIONS TO THE ROLL.

Mr. JOHNS said he was very pleased to note that the membership of the Institution was increasing.

On the motion of Mr. M'GREGOR, seconded by Mr. PETTY, the following were added to the roll of members: Mr. Robert Robertson, Engineer, Mr. T. V. Blake, Chemist (Cardiff), and Mr. T. Anthony Canning (Newport).

PRESENTATIONS FOR JUNIOR WORK.

Mr. JOHNS pointed out that this was the first occasion on which the Senior Association had thought fit to reward junior members for work done during the past year, and it was a great pleasure to him to be privileged to make the presentations. They were hoping in this way to encourage the juniors to show their capabilities, and in due course qualify themselves to fill the positions which many of the senior members now occupied. He would like to emphasize the fact that on this occasion Cardiff had come to the front. This was probably due to the great efforts of their Engineer, Mr. Madden, who, as they all knew, was Chairman of the Committee having the matter in hand. It was also, no doubt, due to Mr. Madden that so many of his assistants had done so well in the examinations.

Prizes in the form of books, selected by the recipients, were awarded to Messrs. C. Bateman and T. U. Blake (Cardiff), in recognition of having obtained the Diploma in gas engineering; Mr. T. Anthony Canning (Newport), in recognition of having obtained the Higher Certificate in gas engineering; Messrs. B. J. Bell, R. W. Foster (Cardiff), and G. H. Hughes (Chepstow), in appreciation of the work done for the Wales and Monmouthshire Junior Gas Association; and Messrs. T. Huntley (Cardiff) and R. J. Williams (Abertillery), in recognition of having passed the Ordinary Grade in gas engineering.

Mr. B. J. BELL, on behalf of the members of the Junior Association, thanked the Institution for the gifts presented to them, and especially for the encouragement given to the junior members, not merely as a body, but as individuals.

THE NEW PRESIDENT.

Mr. JOHNS remarked that his year of office was now being brought to a close; and there was no need for him to introduce to them Mr. Madden, or to say that the latter would make a most excellent President. Mr. Madden was the Chief Engineer of the very important Company at Cardiff, which they were always very pleased to visit, as they could always see something of the very best, and something new that had been well thought out before being put into operation. Mr. Madden was one of his oldest friends; and it was a great pleasure to him to be succeeded in office by that gentleman.

Mr. H. D. MADDEN, who took the chair amid applause, said his first duty was to propose a vote of thanks to the retiring President. Last year Mr. Johns had taken them to the Morriston Works, at Swansea, which had then just been started. Their design would ever remain as a monument to Mr. Johns, whose year of office as President had been marked with great

success. The President then moved that a hearty vote of thanks be accorded Mr. Johns for his services.

Mr. J. Mogford seconded the resolution, which was unanimously adopted, and acknowledged by Mr. Johns.

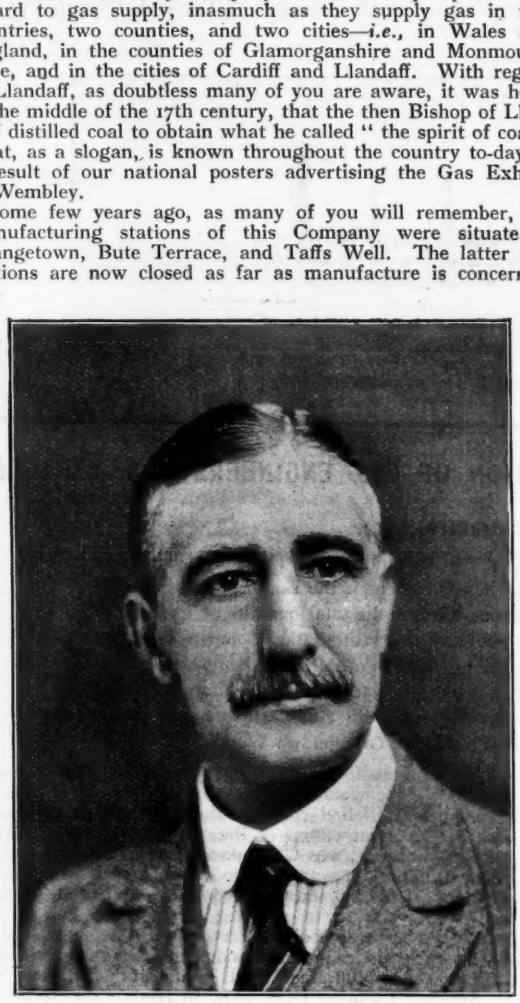
Mr. Madden then delivered the following

PRESIDENTIAL ADDRESS.

In the first place, I desire to thank you for the honour you have conferred upon me by electing me as President, for the second time, of the Wales and Monmouthshire District Institution of Gas Engineers and Managers. It has always been a great pleasure to me to serve in any possible way the interests of our Association; and I will endeavour, to the best of my ability, to further your interests during my year of office.

In welcoming you again to Cardiff, it may be of interest to you to know that my Company are in a unique position in regard to gas supply, inasmuch as they supply gas in two countries, two counties, and two cities—*i.e.*, in Wales and England, in the counties of Glamorganshire and Monmouthshire, and in the cities of Cardiff and Llandaff. With regard to Llandaff, as doubtless many of you are aware, it was here, in the middle of the 17th century, that the then Bishop of Llandaff distilled coal to obtain what he called "the spirit of coal." That, as a slogan, is known throughout the country to-day as a result of our national posters advertising the Gas Exhibit at Wembley.

Some few years ago, as many of you will remember, the manufacturing stations of this Company were situate at Grangetown, Bute Terrace, and Taffs Well. The latter two stations are now closed as far as manufacture is concerned,



THE PRESIDENT, MR. H. D. MADDEN, M.Inst C.E.

and are devoted solely to distribution purposes, or, may I say, have been developed for consumers' service work, while the whole of the manufacture is concentrated at the Grangetown Works. At Bute Terrace are situate the stove and meter repair shops, holder storage, and also the governors and high-pressure supply engines.

The ramifications of mains throughout our district approximate 280 miles, in a scheduled area of supply of 67 square miles. These include both ordinary pressure trunk mains and also high-pressure distribution mains; the latter being used as reinforcers by means of interposed high to low pressure transformers.

The contour of our area of supply is a factor for considerable consideration, inasmuch as the levels range from what is practically just sea level at the works to altitudes of as much as 1000 ft. in some of our outlying districts, and also that three rivers intersect and run from north to south.

Grangetown Works.

With reference to the Grangetown Station of the Company, which you purpose visiting this afternoon, fuller details will be supplied to you later; but I should like to make a few general comments. The area of the works is some 40 acres, and is a few hundred feet from the tidal bay on the one side, partly bounded by the River Ely, which has a maximum tidal fall of 40 ft. The works are served by the G.W.R. Company, with high-level sidings for the gravity discharge of coals, oils, &c., and low-level sidings for the handling of other materials.

My Chairman and Directors have always had in view the ideal of maintaining the works thoroughly up-to-date, working with the highest possible efficiency scientifically as well as commercially. To this end, the results of every 24 hours' work of each plant are carefully calculated, and analyzed by the engineering staff. Each month a commercial balance-sheet is made out, so that the financial efficiency of each plant may be surveyed at regular intervals. This is very advantageous, inasmuch as it is possible to visualize the effect of the processes in detail and as a whole. There has, at times, been a great tendency to strain after the last cubic foot or therm per ton of coal; but in so doing it is possible to lose sight of several valuable factors. The process of carbonization should be of the constructive type; and any manufacture must be looked at as a whole. The balance can only be struck by seeing the working costs of each unit. True, it is important that the utmost gaseous thermal volume be obtained, but it is of equal importance that the greatest amount of coke, and the highest class of tar and ammonia should be obtained, and the effect on the wear and tear of the plant should be borne in mind. To this end, the Grangetown Works are controlled in individual sections as follows:

1. Carbonizing—fifteen beds of vertical retorts with waste-heat boilers.
2. Carbonizing—horizontal machine-stoked retorts—40 sets of 8's.
3. Carburetted water gas plants—two 2-million c.ft. per diem sets with waste-heat boilers.
4. Carburetted water gas plants—three 1-million sets of plant.
5. Sulphate and liquor of ammonia plants.
6. Coal-gas and water-gas for tar dehydration plants.
7. Breeze and ash washery and recovery plants.

Using a mixture of 35 p.ct. of Yorkshire coal and 65 p.ct. of Welsh coal, the average production from the two types of carbonizing plant gives some 74 therms per ton of coal. Tests for calorific value are taken at regular intervals throughout the day.

Mechanical processes have been widely adopted—viz., from the unloading of coal and the elevating and storage of same, to the coke storage into the yard bunkers. In the manufacture of chemical recovery products, mechanical means are also fully utilized. On the yard several loco travelling cranes have been installed to facilitate the work and ease labour.

Since your last visit, much work has been carried out, and the general idea of reconstruction and extension has been brought nearer to a point of completion. Workshops have been centralized and modernized on a new site. The tar plant has been extended and placed in a new position, with greater facility for barrelling and loading, while at the same time a centralized new mess and dining room have been constructed for the accommodation of the men who stay on the works for meals.

There is another side to my Company to which I should like to refer—viz., co-partnership, which has been in operation now for fifteen years. This fell partly into abeyance during the latter war years, but was strengthened and rehabilitated by the Cardiff Gas Act of 1921; the portion of the Act referred to being similar to, and based on, the South Metropolitan Act of 1920, wherein consumers, co-partners, and shareholders benefit by the good working and conduct of the Company—the consumer receiving two-thirds of such benefit. This co-partnership is an inducement to combined effort towards reducing the price of gas to the lowest possible figure. There is also another feature of our co-partnership—the social and athletic side; and some 4½ acres of ground at Grangetown are devoted to recreation, affording facilities for cricket, football, baseball, tennis, &c., and there has also now been added a skittle rink. It is a pleasure to say that there are some 700 contributing members in our Athletic and Social Club, which not only caters for outdoor sports, but continues its activities during the winter months in providing indoor recreation and entertainments. The annual sports of the co-partners is always a red-letter day for everyone connected with the Company. Such an organization confers great benefit, and it is noticeable in what one might call better health of the individual, to say nothing of that promotion of good fellowship and camaraderie of the different branches of the Company's employees, &c. May I add that my Company gives direct employment in this city to about 700 staff and men, and, further, the Company form one of the largest ratepayers—both factors of considerable importance. Its prosperity is therefore indelibly bound up with that of the city itself.

The Industry Generally.

The magnitude of our industry and the service it renders to the public are not realized by the public in general. In the first place, we are one of the largest users of coal—and, mark you, we constructively utilize and develop, so forming other key industries. The total quantity of coal carbonized by the gas industry is approximately 18 million tons per annum, producing 10,000,000 tons of coke (as smokeless solid fuel), 172,020,000 gallons of tar, and 167,000 tons of sulphate of

ammonia. In dealing with this huge quantity of coal, the industry also supplies 275 thousands of million c.ft. of gas per annum for lighting, heating, cooking, and trade and industrial purposes. This volume of gaseous energy is delivered to the point of ignition through pipelines, and the method has immense advantages. These are: The transport of coal and ashes in our large cities and towns is materially eased at a time when congested road traffic is already a serious problem; the work of collecting household ashes is enormously reduced, to the benefit of the local authorities; and, most important, smoke and noxious vapours, which pour from the household chimneys when raw coal is used, vitiating the atmosphere, and so reducing the hours of sunshine, are lessened. Pure sunshine is Nature's health restorer, because the sun's radiant heat rays are the great healer, and the greatest adversary of disease. These rays are filtered out when passing through a screen or pall of smoke. Increased sunshine means increased health, especially to growing children; and our industry has done a great service in this direction. Work, however, remains to be done, until the day when it will be a barbarism and a crime to consume raw coal in open grates. The writer has often heard the clearness of Cardiff's atmosphere commented on by visitors, and sometimes by citizens. It is as desirable to keep the air clear and bright as it is that the water supply should be of the purest quality.

In our district of supply nearly 45,000 cookers are in use, and some 30,000 gas fires and washboilers. It is rapidly being realized that gas appliances in the home relieve domestic labour, are economical, very clean, and can be turned on and off at a moment's notice. Trade and industry are also rapidly realizing the benefits that gaseous smokeless fuel provides in the various heat treatment methods which are being employed. The field of output in this direction is enormous, and another great factor towards eliminating the smoke nuisance.

Subsidy.

There has recently been considerable discussion on the subsidization of industry. At the moment I am not referring to the special subsidy granted by the Government to the coal industry, but to industry in general. The national sturdy businesses have been built-up and kept going without subsidies; and if we are to retain that spirit of enterprise, then industry must be independent of subsidies. The gas industry has had to work for one hundred years without it; but unfortunately several schemes have been dragged into the political arena and set up as palliatives and cures for all the industrial ills of the present time. Some desire Government assistance to set up low-temperature carbonization plants at the pit-head. Apart from the point that low-temperature carbonization has not yet proved itself a commercial success, there are many factors that militate against such a scheme. The solid fuel and gaseous energy would have to be conveyed to the towns, and practically the same weight of manufactured materials would have to be transported to the centres as would be the case if the coal was delivered to gas-works, which are situated in their own district of supply for heat energy, and which, moreover, have spent large sums in the provision of carbonizing, purifying, and auxiliary plants, which would become redundant. If low-temperature carbonization becomes financially possible, and if there is a good demand for low-temperature fuel, then the gas undertakings will unquestionably utilize the system, seeing that they are already equipped with all the necessary auxiliary plant and distributing systems, which cost several times as much as the carbonizing plant itself. More could be said on the ineffectiveness of this proposal; but you will readily fill in the gaps with your engineering, financial, and general gas supply experience.

Another group find the palliative to industrial ills in the provision of super-power electric stations—the words have a good ring about them, and no doubt attract the lay mind. Our electrical engineer friends of the existing large power stations have great experience in the manufacture and supply of electric energy; but I question whether they welcome such possibilities, or believe that unemployment will ultimately be relieved by such methods. Again, given electric power a fraction of a penny cheaper, would industry revive? It could not. The causes lie much deeper; and if we examine the position of the north-east coast to-day, where electric energy is as cheap as in large American manufacturing towns, what do we find?—That unemployment is more rife and acute in the north-east engineering and shipbuilding yards than in any other part of the kingdom. Can an electrical subsidy relieve the position? No. Subsidy to one industry is unfair to other large industries developing on their own lines. Electrical undertakings can raise new capital on very favourable terms, and the financial returns of these may be gathered from the published list of investments wherein the rates of dividends are thoroughly good, especially when compared with the stautorily governed gas undertakings.

Examine the words "super power stations." What really do they convey? The new electric power station recently opened by H.M. the King provides energy in a minor way as compared with some of the large gas-making stations. For instance, the Gas Light and Coke Company, who supply part of London, alone send out more heat energy than the whole of the electric undertakings of the United Kingdom. The annual extensions of works plant of this Gas Company alone have a greater energy output than the Barking super-power station. In face of these facts, one may ask what authority has Parliament to contemplate subsidy, and unduly favour one side of energy supply against the older sister, more especially as the gas industry returns in various useful forms 80 p.ct. of the original coal supplied for carbonization, against an anticipated thermal efficiency of 20 p.ct. for the super-power station, and an average of under 12 p.ct. thermal efficiency for the whole of the electrical undertakings of Great Britain.

I am of opinion that, being engineers first and partisans afterwards, our brethren the electrical engineers and the gas engineers could, if they united their brains, do more to solve the problems of coal conservation and cheap energy production and supply than any lay-minded political body.

Tar.

The tar problem has been acute during the past year. Tar is a product that largely affects the selling price of our gaseous fuel. It is the most complex and wonderful of our industry's chemical products. It is a key industry in itself, and is the basic British product of light oils for motor propulsion, and the most fertile base for high explosives for the mining industry or for national defence—as witness the tremendous amount of tri-nitro-toluene and amatol bases furnished by our industry in the late European war, for which no adequate recognition has ever been given to our industry by the British public. Antiseptics, synthetic dyes, perfumes, printers' inks, creosote, preservative oils, pitch, and road making materials, &c., are among the derivatives of coal tar. Remember, a nation that neglects its gas-works places itself at the mercy of a foreign foe that cultivates them. The electrical industry can never provide these necessities by the methods they at present adopt in converting coal into energy.

It is greatly to be regretted that so much foreign petroleum residue for road-making has been recently imported. "British tar for British roads" should be our slogan. Give the road-making trade to our countrymen, and not to foreigners. I am sure I am voicing the view of all British workmen when putting forward this ideal. When you are at the Grangetown Works I would ask you to notice the roads made throughout with ordinary distilled tar, and subject to nearly two years' heavy horse and motor traffic wear. I venture to think you will be more satisfied with the surfaces than those you are familiar with in many of our highways treated with foreign-made substances, which are inimical to the best interests of our own workmen and the British tar industry. The tar and road exhibit of our industry at Wembley this year is a salient proof that British tar can make the best of roads.

Coke.

The potentialities of coke, our solid smokeless fuel product, merit more attention. Chemically, it is similar to anthracite, and acts under combustion in a similar way. Much improvement could be made if this product was graded into sizes, as it has been found that under these conditions it can be utilized for practically all domestic, trade, and industrial conditions where heat is required from solid fuel sources. The extended use of coke in these directions would do much to reduce the smoke evils of our towns and cities; and it is our duty to keep the public fully advised of its usefulness.

Education and the Industry.

To provide for the future personnel of our industry, it is vital that technical education should be developed and materially encouraged among all ranks, with due recognition by promotion and improved conditions for the individual so qualifying. It is gratifying to find the response given by the juniors to the new scheme of education and series of examinations provided by the Institution of Gas Engineers, in collaboration with the Educational Authorities. Permit me to say that never in the history of our industry has technical development been more necessary than now, not only in development of science for works practice and investigation, but also in the ever-growing range of consumers' service work. We trust that all boards of directors and gas committees will give their strongest support to this object.

It is to the good that the Junior Associations press heavily on the senior organizations for increased opportunities to study all aspects of our practice; and and in this matter I should like to pay a tribute to the fine work and the strong position attained by our own Junior Association in South Wales and Monmouthshire, who are developing on the most progressive lines, and whose collective effort is assisting to consolidate the general position.

The ramifications of our industry are very wide, and offer great scope; and one would like to see the public school men more and more attracted to our service—their education and general cheerful outlook naturally fit them for training and ultimately for responsible administrative positions. I should also like to pay a tribute to the Cardiff Education Authorities. We are having a good class of boy for fitters' apprentices; and their continued part-time technical education is on a very sound basis, and will prove invaluable to the boy and the service. Given education on proper lines suited to each grade of apprentice, student, &c., thereby imparting a wider knowledge and

wider interest, I am sure a good atmosphere will be created in their lives and their general surroundings, and will be of benefit to the community at large.

Summing up the position, it is apparent that the future of the industry is full of promise, providing always that the personnel, from chairman to the latest recruit, are interested, enthusiastic, and pull together with one definite objective—*i.e.*, the development and progress of the gas industry. Therefore I am a strong supporter of the principles of co-partnership, wherein all concerned benefit—consumer, employee, and shareholder. It is in reality the engineers' principle of the triangulation of forces—in design of work so necessary, in industrial life more necessary still.

It is my most earnest desire that all our proceedings, initiative, and work co-ordinate in one great objective—that is, to render the best of public service, to obtain the hearty co-operation and goodwill of every section of our workers, together with their welfare, and to try to make the gas industry a service wherein it is a great privilege to be allowed to serve. Towards this end the greatest of all factors is the "human element." Enlist this on our side, and the magnitude of this force is irresistible. Of our industry, let the password be "Floreat."

THANKS TO THE PRESIDENT.

Mr. C. F. BOTLEY said it was a very great pleasure to him to move a vote of thanks to the President for his inspiring address, the keynote of which was service. The wonderful industry with which they were associated called for every ounce of energy they possessed. One point he would like to refer to was that of education, and the President's remarks bearing on examinations. Book knowledge alone was not sufficient, and hence the importance of the Junior Associations. Splendid work had been, and would be, done by the Junior Associations. Unfortunately, at present there was no real means of classification; but when this was done, it would result in the raising of the status of gas engineers. He concurred with the President's observations regarding the subsidizing of industry. The coal industry was subsidized; but with this experience, it would be a brave Government who would dare do the same for the electrical industry. They needed to educate the public, who did not know what the gas industry was doing.

Mr. JOHNS, in seconding, said he entirely agreed with Mr. Madden as to the lack of publicity given to the gas industry. The more the public mind was enlightened, the more gas would be used. He thought that in the future more gas would be consumed for lighting purposes, and, if only they advertised more, for heating and cooking also.

Mr. F. W. GOODENOUGH described the address as both interesting and inspiring. He emphasized the services which Mr. Madden had rendered in regard to education—a subject which he (Mr. Goodenough) had much at heart. There was every indication of a large influx of students under the Institution's scheme this year, and in Wales it had received more support than anywhere—not even excepting Scotland.

Mr. A. E. DAVEY (Aberdare) associated himself with the remarks of the previous speakers.

Mr. DOVEY also supported the motion. He had come expecting to hear something of value, and had not been disappointed.

The PRESIDENT, in response, said he felt that the matters which he had dealt with would have to be faced. "What I said in my address," he added, "I believe in, and firmly believe in; and I should like during my year of office to have the strongest support from the Junior Association."

REPRESENTATIVE ON THE INSTITUTION COUNCIL.

On the motion of Mr. W. CLARK JACKSON (Neath), it was unanimously agreed that Mr. Johns be their representative on the Council of the Institution of Gas Engineers for the year commencing June, 1926.

PLACE OF NEXT MEETING.

On the motion of the PRESIDENT, seconded by Mr. DAVEY, it was agreed to leave the Council to decide the place of next meeting.

INCREASE IN GAS CONSUMPTION.

Mr. GOODENOUGH, dealing with the future prospects of the gas industry, stated that the annual increase in the sale of gas for the five years ended 1907 averaged 4400 million c.ft.; for the next five years, 4800 million c.ft.; for the five years ended 1917, 5400 million c.ft.; for the five years ended 1922, 6600 million c.ft.; and in the last two years, no less than 8500 million c.ft.—or twice the annual increase fifteen years ago.

LUNCHEON PROCEEDINGS.

The members and visitors—nearly a hundred in all—were then entertained at luncheon at the Park Hotel by the Chairman and Directors of the Cardiff Gas Company. The proceedings were presided over by Mr. DOVEY. After the Loyal Toasts had been honoured,

The CHAIRMAN submitted "The Wales and Monmouthshire District Institution of Gas Engineers and Managers." These conferences, he said, were conducive to good management and efficiency in working. Co-ordination and interchange of knowledge and experience had a cumulative effect, and were of permanent and outstanding value to the gas world generally. By co-operation in dealing with fundamental matters of manufacture and management much would be achieved. These local conferences were valuable in this way: In the bigger general assemblies local conditions and difficulties were sometimes lost sight of; but here there was more intimate association, and they could more effectively deal with the matters which closely and immediately affected themselves. Faced with keen competition, the gas industry had risen to the occasion. The energy, zeal, and powerful influence of the British Commercial Gas Association and kindred organizations had been of untold value to all undertakings, both large and small. A good deal of educational and propaganda work yet remained to be done. Research work by the engineer and manufacturing chemist was still necessary, and development would be carefully watched. The Government, through the Board of Trade, had recognized the hardship of the industry's position, both in regard to manufacture and finance. Many anomalies had been removed under local parliamentary powers, and, generally, they had greater freedom of action; but no privileges, excepting those to which they were legitimately entitled, had been granted. Only fair and equitable conditions prevailed. Their's was a big and important industry. He might be forgiven if he said that, of the total gas sold in Wales, one-third was supplied by the Cardiff Gas Company from the Grangetown Works. During the past eighteen years the output of gas from the Grangetown Works had been doubled—to be exact, there had been an increase of 103 p.ct. They did not meet their responsibilities unless they had full regard for what was due to the consumer and the shareholder. The local co-partnership scheme was operating very well indeed, and nearly 500 of the workers were shareholders in the Company. An extension of the principles of co-partnership to all industrial undertakings would, he confidently believed, help very materially to solve the present serious labour troubles. Gas had nothing to fear, so long as it had not to encounter unfair competition, such as the proposed subsidy to the electrical industry. The gas industry had strength and vitality; and they could never fail so long as they were true to themselves. Concluding, he said: "I link the name of Mr. H. D. Madden, your new President, with the toast. By your electing that gentleman again to the highest honour it is in your power to bestow, you have testified to your high estimation of his many varied gifts as a skilful business administrator and efficient gas engineer. In doing honour to him, you give us as Directors great pleasure. Mr. Madden stands conspicuously to the front in the higher realms of the British gas industry."

Mr. MADDEN, in response, reminded those present that it was only twenty years ago that the local Institution was formed; but at that time they could not have had a meeting such as they had that day. They now had their technical and commercial section meetings. In fact, hardly a fortnight passed without two or three meetings being held by the executive officers. He took that opportunity, on behalf of the Institution, of expressing gratitude to the Chairman and Directors of the Cardiff Gas Company for the great assistance they had given the Institution. The Chairman had placed a room at the Bute Terrace offices at their disposal, whenever they wished to hold any meetings. One of the features of that day was the inauguration on the part of the senior organization of a scheme for providing a number of prizes for the Junior Association, and they were the first district in the country to adopt such a method of encouraging enterprise on the part of students. This step had been taken consequent upon the realization that they must have technical training in the industry. Then the consumer needed to be educated in the domestic and industrial applications of gas. At Cardiff they had been kept busy throughout the summer fixing-up gas fires. It was up to them to help Mr. Goodenough in the campaign which he was conducting, not only by sending-on to him "the sinews of war," but by developing the campaign in their own towns and villages.

Mr. BOTLEY submitted "The Cardiff Gas Light and Coke Company," and said he desired to thank the Chairman and Directors for their generous hospitality. He had had an opportunity that morning of visiting the Grangetown Works, and had no hesitation in saying—and Mr. Doig Gibb would confirm it—that their admirable conception formed a most striking example of up-to-date works. The works were such that Mr. Madden was able to get the utmost value out of them. Those who visited the works would realize the confidence which the Directors had in the future of the gas industry. He hoped the Company would long continue on the enterprising lines hitherto adopted, and attain even greater success in the future.

The CHAIRMAN, responding, said that for a period of fifty years, with the interruption which affected all industries during the war, his Company had paid the maximum dividend. Their idea was to consolidate, improve, and maintain at the highest efficiency the undertaking of which they had control; and to him it was very pleasing to note that for many years past they had not had a single written complaint of inefficiency. This was largely due to the staff, who supported the Directors; while their relationship with the workpeople was also very happy. For many years Mr. George Clarry had been a conspicuous figure; and now in Mr. Madden, Mr. R. J. Auckland (the Secretary), Mr. B. J. Bell (the Superintendent), and Mr. F. Boardman (the Assistant Superintendent) the Company had the services of men of very high qualifications, whose one objective was to render efficient service. During the past eighteen years, the Company had not hesitated to adopt any suggestions made by their Engineer, and with good results. The prosperity of the gas industry was very largely in their own hands; it depended upon their giving effective and efficient service. He hoped that he and his co-Directors would again be privileged to entertain the Institution.

The toast of "The Visitors" was given by the PRESIDENT, and responded to by Mr. GOODENOUGH and Mr. DOIG GIBB.

THE GRANGETOWN WORKS.

The party afterwards left the hotel in conveyances for the Grangetown Gas-Works, where an interesting and profitable afternoon was spent in the inspection of the plant, under the

guidance of Mr. Madden and his assistants. The following description of the plant was prepared for the occasion.

MANUFACTURING SECTIONS.

The Grangetown station comprises three complete sections of gas manufacturing plant, each unit being complete with its auxiliary plant, together with residual plants. The coal is delivered into the works by five sets of high-level gantry railway running the full length of the retort house coal stores. The wagons are discharged by a number of hydraulic rams situated above the seven coal breakers and elevators.

No. 1 Section.—Vertical retorts, comprising fifteen settings of eight retorts of the Glover-West type and waste-heat boiler. The carbonizing capacity is 300 tons of Welsh coal per 24 hours. The coke is handled by a system of telpherage, either to the yard or to the two sets of coke storage bunkers. This telpher also supplies coke to the C.W.G. overhead coke bunkers, and breeze to No. 1 boiler house. The whole of this section is electrically driven by current supplied from No. 1 power house adjoining. Five electrical generating units are employed, gas engines supplying the motive power.

No. 2 Section.—Horizontal retorts, comprising forty regenerative settings, each of eight retorts 20 ft. long. The carbonizing capacity is 430 tons per 24 hours. The retorts are machine stoked by two Fiddes-Aldridge electric stoking machines. The coke is handled by coke conveyors (Messrs. West's), and taken direct to overhead storage bunkers of 400 tons capacity. No. 2 power house supplies electric power and compressed air for the various requirements of this section of the works.

No. 3 Section.—This section comprises two Humphreys & Glasgow carburetted water gas sets, each capable of producing 2 million c.ft. of gas per diem, complete with waste-heat boiler, each set capable of supplying 3500 lbs. of steam per hour. This section is also complete with its own exhausting plant, &c. The coke and ashes are handled by travelling cranes. The reserve plant consists of three 1 million c.ft. per diem sets, which are to be transferred to the new site.

Washing and Scrubbing Plant.—Each of the above sections has its own condensers and washer scrubbers. No. 1 yard comprises two sets of annular, and two large water-cooled, condensers, four tower scrubbers, and two rotary washer-scrubbers by Messrs. Kirkham, Hulett, & Chandler. No. 2 yard comprises one set of vertical condensers, partly annular and partly water-cooled, and one set of Graham type condensers, two Livesey washers, and four rotary brush washers (of the Holmes type).

Dry Purification.—This consists of four sets of purifiers, each of six boxes. No. 1 and No. 2 sets are on the ground floor, the former comprising six boxes of 38 ft. by 16 ft. 3 in. each, and the latter six boxes, each 24 ft. by 24 ft. No. 3 and No. 4 sets are elevated boxes, filled by means of hand conveyors; revivification taking place on a concrete floor underneath the boxes. No. 3 set comprises six boxes 40 ft. by 24 ft., and No. 4 comprises six boxes 50 ft. by 30 ft. A No. 5 set is in course of construction, and the first two boxes are by Messrs. C. & W. Walker—size 40 ft. by 30 ft.

RESIDUAL PLANTS.

Tar Dehydration Plant by the Chemical Engineering Company; capacity 4000 gallons of crude tar per 24 hours. The plant by Messrs. Holmes has a capacity of 5000 gallons per day.

Sulphate of Ammonia Plant by the Chemical Engineering Company comprises two sets, each of 4 tons capacity. The plant is equipped with a neutralizing and final drying apparatus. The salt now produced is perfectly dry, contains no free acid, and attains 21·1 p.ct. nitrogen.

Concentrated Ammonia Plant by the Chemical Engineering Company; capacity 20,000 gallons per 24 hours.

"Notanos" Washery by Messrs. Head, Wrightson, & Co., Ltd. This is designed for dealing with retort-house ashes, and separates the combustible matter therefrom for boiler use. It is fitted with elevated bunkers, and has a capacity of 50 tons per working day of eight hours. This plant is situated at the north gable end of No. 2 retort house, in a position convenient to receive the ashes from the various furnaces on the works.

"Draper" Washery by the Rhondda Engineering Company, Ltd. This is designed for breeze washing or washing ashes. It is fitted with elevated ferro-concrete bunkers, and has a capacity of 50 tons per working day of eight hours. The Draper washer is at present employed on coke grading and screening; the grades of coke offered for sale being broken, nuts, and beans.

DISTRIBUTION OF GAS.

From the holders the gas is delivered to the trunk mains supplying the district through a system of governors which control the supply to the various portions of Cardiff and neighbourhood. The governors also control the supply of gas to the Bute Terrace and Taffs Well stations, where holders are in operation to supply districts immediately adjacent. Two Rateau fans are in use for raising the pressure during periods of exceptional demand, and one Belliss & Morcom compressor is employed for supplying a large outlying area. This compressor is capable of dealing with 300,000 c.ft. of gas per hour at 30 lbs. pressure, and supplies through a 12-in. steel main a distance of five miles, and works in conjunction with a transformer station at Whitchurch.

A large and well-equipped laboratory and coal testing plant adjoin the governor house; and the works are provided with carpenters', smiths', and engine fitters' shops, equipped with modern machine tools.

FORTHCOMING ENGAGEMENTS.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

Oct. 3.—MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.—Visit to the Bolton Corporation Gas-Works, followed by a general meeting.

Oct. 6.—INSTITUTION OF HEATING AND VENTILATING ENGINEERS.—Autumnal general meeting at Caxton Hall. Paper by Mr. E. Owen, B.Sc., on "Practical Measurement of Air Flow."

Oct. 10.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Meeting at Edinburgh. Address by Mr. W. B. M'Lusky, of Halifax.

Oct. 14.—INSTITUTION OF ENGINEERS-IN-CHARGE.—Meeting at St. Bride Institute, at 7.30 p.m.

Oct. 15.—MURDOCH LODGE.—Meeting.

Oct. 16.—NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.—Autumn meeting at Stockton-on-Tees.

Oct. 19-21.—BRITISH COMMERCIAL GAS ASSOCIATION.—Annual conference and general meeting in Plymouth.

Oct. 28.—EVENING STAR LODGE.—Meeting.

Oct. 30.—LONDON & SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at the Westminster Technical Institute.

Nov. 7.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Joint meeting with Western District, at Glasgow.

Nov. 18.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Meeting at the Hotel Cecil, Strand, W.C. 2, at 2.15 p.m.

Nov. 25.—EVENING STAR LODGE.—Meeting.

Dec. 5.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Visit to the Alloa Gas-Works. Paper by Mr. W. Scott.

INSTITUTION OF GAS ENGINEERS.

Oct. 12.—2.30 p.m., Refractories Research Joint Committee.

Oct. 12.—4.15 p.m., Calorimeters Committee.

Oct. 13.—4.0 p.m., Consultative Committee of the Education Scheme, followed by meeting of the Advisory Committee.

Oct. 14.—6 p.m., Joint Meeting, at the Institution of Civil Engineers, Great George Street, Westminster, with bodies co-operating in the work of the Special Committee on tabulating the results of heat engine trials.

Oct. 14.—10.30 a.m., Emergency Committee. 11.30 a.m., Council. 2 p.m., Finance Committee. 3 p.m., Wrought-Iron Tubing Inquiry Committee.

Oct. 22 (provisional).—2.30 p.m., Emergency Committee. 3.15 p.m., Finance Committee. 3.45 p.m., Council Meeting.

Nov. 10.—4 p.m., Advisory Committee on Education.

Nov. 11.—11.30 a.m., Emergency Committee. 12.15 p.m., Benevolent Fund Committee of Management. 12.45 p.m., Finance Committee.

Nov. 25.—11 a.m., Institution's session at the Public Works, Roads, and Transport Congress.

Dec. 2.—Official visit to the Shipping Engineering and Machinery Exhibition at Olympia.

Dec. 8.—4 p.m., Advisory Committee on Education.

Dec. 9.—11.30 a.m., Emergency Committee. 12.30 p.m., Finance Committee.

Internal Combustion Engineering.—Messrs. Longmans, Green, & Co. have published, at 10s. 6d. net, a book entitled "The Elements of Internal Combustion Engineering," by Telford Petrie, M.Sc. It deals almost entirely with what may be termed the "paper" side of engineering, and leaves all practical details to the books on design proper.

Determination of Carbon Monoxide.—In a recently issued Technical Paper, the United States Bureau of Mines refer to the pyrotannic acid method for determination of carbon monoxide. In their investigation of many cases of industrial and domestic poisoning from carbon monoxide, they found it necessary to develop a method and apparatus that could be immediately taken to the scene of an accident, and which would give accurate results as to the carbon monoxide in the blood and in the air. The method they describe has been in use frequently during the past two years and has shown itself to be reliable and accurate, and admirably to fulfil requirements for the examination of blood and air. Its simplicity and ease of operation are said to render it well suited to the needs of hospitals, surgeons, engineers, &c. The Technical Paper which deals with the matter is No. 273.

RECENT DEVELOPMENTS AT SCUNTHORPE.

By J. F. SIMPSON, M.A., B.Sc.

[A Paper before the Eastern Counties Gas Managers' Association Sept. 23, 1925.]

It is with no little diffidence that I place the following remarks before you—a diffidence caused on two very distinct counts. The first of these is a doubt of my ability to place my experiences in their proper perspective, and in such a way that they may be of some interest to you; the second, a natural reluctance to broadcast results which did not come up to general expectation. But in the long run I yielded to the importunities of your President, and would like to take the opportunity, here and now, of thanking you through him for the honour you have done me in asking me to give particulars of the work at Scunthorpe within the last three years. I need not say that it is an honour which I thoroughly appreciate; and I only hope that your time this afternoon will not be altogether wasted.

To begin with, it will not be out of place to give a résumé of the circumstances which led to the commencement of a new gas-works at Scunthorpe. In the year 1919 the send-out was 94,000,000 c.ft. The manufacturing plant to meet this consisted of one bed of eights, six beds of sixes, and one Tully plant of a nominal capacity of 150,000 c.ft. per day. The retorts were in a broken-down condition. Mr. Moore, the then Manager, was carrying on heroically under extreme difficulties, but managed to find the time to prepare plans and estimates for a new gas-works. These plans called for a large capital expenditure; and Mr. Doig Gibb was called in to advise and report. He endorsed Mr. Moore's scheme on the whole; and, as extension was urgent, preliminary arrangements for the construction of the new works were at once put in hand.

It is only fair to Mr. Moore to state that his original scheme and estimate drafted in 1919 seem to the writer, who has carefully considered them, to be remarkably good, and to offer very few loopholes for adverse criticism. The possibilities of the new site were carefully explored, and the best use was made of them. The design as a whole was in accordance with the best modern gas-works practice, including as the manufacturing unit a setting of vertical retorts with provision for water gas manufacture at some subsequent date. In fact, the lay-out of the plant as existing now is very similar to Mr. Moore's original scheme, and I have received many valuable hints from his drawings. The fact that Mr. Moore could have got out such a scheme when at the time he was contending with a worn-out and overloaded plant is a wonderful tribute to his untiring energy and technical skill.

The new plant was actually commenced in 1921. The prices quoted for manufacturing plant being, at the time, prohibitive, the boiler house, purifiers, and tar and liquor tanks were first erected, in the hope that costs would ease somewhat before the end of the year. The contract was also let for a 500,000 c.ft. holder. Towards December, however, the manufacturing question had to be faced. Prices were still very high, with the result that the Council ultimately decided to rely entirely on internal combustion gas generators as generally designed by Mr. Moore, but specifically detailed and guaranteed as to results by Messrs. Ashmore, Benson, Pease, & Co., Ltd., of Stockton. The terms of the guarantee were that, on a 24-hour continuous test, using best-quality double-screened gas nuts, and working at a constant load factor, an output of 25,000 c.ft. of gas per ton of coal treated should be obtained, of an average calorific value of 425 B.Th.U. gross at N.T.P. This guarantee was actually fulfilled. Unfortunately 425 at N.T.P. means 397 under Gas Regulation Act conditions—a fact which I am inclined to think escaped notice at the time of signing the contract.

At this stage, in the beginning of 1922, I succeeded Mr. Moore at Scunthorpe. It was hoped to get the new plant going before winter set in, but the engineers' strike in the spring destroyed all hope of that. The delay, however, proved a blessing rather than the reverse, as it gave me time to reconsider the proposed exhausting and condensing scheme which had been very hurriedly drawn-up, and concentrate on the steam plant and other less important ancillary apparatus. As it is not proposed to refer to these again, I shall at this point give a brief description of some of them.

There is nothing particularly interesting about the steam-raising plant. The two unusual features (from a gas-works point of view) were the comparatively large evaporation required and the extreme hardness of the water to be evaporated. The first was met by the installation of Meldrum's forced-draught system; and dish-ended boilers were selected to meet the second condition, the absence of stays in the ends facilitating cleaning and scaling. The boilers were supplied and erected by Messrs. John Thompson, Ltd., of Wolverhampton, and are fitted with their superheaters. The middle section of each fire tube is fitted with a corrugated length to provide for expansion and contraction.

The yard mains were put down with an eye to the future. They are all of 20-in. diameter, and are so arranged that the whole of the valves beyond the purifier outlet are housed under the same roof as the meter and governor. Provision is made in the meter house for a small laboratory, so that sample lines should be as short as possible, while connections are left for a second holder the valves of which will also be accommodated in the house. A common holder by-pass suitable for both present and future holders is provided. The station meter is a wet meter of the usual type built by Messrs. Parkinson & Cowan, and is of a capacity of 60,000 c.ft. per hour.

DESIGN OF STATION GOVERNOR.

The station governor was constructed by Messrs. Peebles & Co., Ltd., to the design of the writer. The usual trouble of low pressures at the finger tips of the district at times of maximum consumption was present in an extreme form at Scunthorpe, and it was felt that some form of automatic self-loading governor was a necessity. The ideal governor of this type is, of course, one that throws a pressure proportional to the demand for gas at any time. In this governor the ideal is approximately attained by means of a rolling weight which moves over a curved track in such a way that the moment of the weight is proportional to valve displacement. To prevent variations in inlet and outlet pressure affecting the discharge per unit area of valve opening, a differential governor is placed on the inlet side of the main governor and connected so that it maintains the differential pressure across the main valve constant. The governor was designed for any required variation of pressure between the limits of 2 and 8 in. water-column. Actually it has been in use for the limits 3 to 6 in.

As a matter of academic interest rather than as a question of any practical importance, I checked the proportionality of this governor. By comparing the daily send-out with the area of a Bristol recording chart on several occasions, I obtained a constant for the governor set at a given range and differential. The charts were then taken for a month, integrated, reduced to cubic feet, and compared with the send-out as per the station meter and holder readings. The gas was corrected for temperature and pressure, and the agreement was within 2 p.ct. There were certain daily variations from the straight-line law considerably more than this, and I am afraid the total agreement was more accidental than otherwise; anyhow it proves that a certain degree of proportionality was attained, and the original purpose of the governor realized. Unfortunately there was no time to pursue the investigation further, though I hope to be able to take it up again at a later date.

Before leaving this subject, which I hope you will pardon me for labouring somewhat, I would like to make two personal references. One is to Colonel W. Carmichael Peebles, my partner in the design of the governor, without whose invaluable help the idea would never have materialized. The second is to Mr. John Leather, formerly of Burnley, who, as far back as 1885, took out a patent for a governor embodying exactly the same theoretical principles which Colonel Peebles and I thought we had made use of for the first time. It was only when the Patent Office began quoting prior patents against us that we made the discovery that we had been anticipated—and that nearly forty years before.

SELECTION AND ARRANGEMENT OF AUXILIARY PLANT.

Let me return now to the exhausting and condensing plant. The treatment of the gas from the off-take of the generators to the inlet of the purifiers was a subject which was considered from every possible point of view. Each scheme as it presented itself was meticulously criticized for faults; and a fairly vivid imagination did not tend to decrease the difficulties. Standard coal gas practice was very little use as a model. Standard carburetted water gas practice (of which the writer has had considerable experience in the States) was even less use. There was no precedent to follow, and experience with Tully plants, which were half-brothers of the new system, had led to a wholesome fear of stopped-up pipes and condensers. If the new plant had been merely an auxiliary unit, ultimately discharging into (say) an hydraulic main already conveying gas from another source, the problem would have been much simplified. In addition this part of the plant had to be arranged so that it could cope with a coal gas installation if necessary at any time in the future, with due regard to possibilities of ammonia recovery.

But, among a host of minor and more or less debatable details, there were three cardinal conditions which undoubtedly had to be satisfied if the new generating plant was to have a fair trial. These conditions, in the order of their importance, were:

(1) The generators must be so connected with the condensing plant that the pressure at the top of the retort should not at any time, and particularly during the blow, exceed the atmospheric.

(2) The gas must be cooled as soon as possible after leaving the generators, and must be cooled by direct contact with the cooling water.

(3) The exhausting plant must pass gas at a reasonably constant rate.

Briefly, the reasons for these conditions were as follows:

(1) As the operating stage was at the coal feed level (*i.e.*, at the top of the retort), any considerable leakage of gas into the house was not permissible. Again, the process of distillation being a continuous one, provision had to be made for the abstraction of the coal gas made during the blow period. Otherwise that valuable gas would pass down the retort and escape with the blast products.

(2) The writer's experience with producer gas and water gas made with coke (as opposed to anthracite) seems to prove that such gases, as distinct from ordinary straight coal gas, are surcharged at the point of leaving the generating vessel with a fine, almost colloidal, dust which, when mixed with coal tar, forms a species of cement which is sometimes very hard to remove. Obviously, this dust, if formed, must be removed from the pipes as speedily as possible; and just as obviously a water tube condenser or any form of surface condenser would be constantly liable to cause trouble through choking, as the deposit would always occur in constricted areas. Even if actual choking did not occur, any deposit on the cooling surfaces would result in a loss of condensing efficiency.

(3) Condition (3) above was imposed by the necessity of maintaining a more or less constant rate of flow through the purifiers. The capacity of purifying boxes is limited not by the average rate of gas passed per hour or per day, but by the maximum at any particular instant. With only one generating unit in service, that maximum rate seemed likely to cause trouble, though data were lacking to determine exactly to what extent. Only three boxes had been provided, and those with hurdle grids; and one could afford to take no risks under these conditions. The effect of sudden and frequent variations in the rate of flow upon the accuracy of the station meter had also to be considered.

These points led to the final evolution of two schemes, both of which had their weak characteristics; and the question became one of which scheme was the lesser evil. Both schemes involved a direct-contact cooler placed as near as possible to the generators, a turbo-exhauster on the outlet of the cooler, and a relief holder on a spur between the cooler and exhauster. But the dilemma arose because of the fact that (at least during the blow, and if possible during the whole cycle) the top of the generating vessel had to be maintained at a pressure under atmospheric. The obvious way out of the difficulty was to counterbalance the relief holder so as to throw the required vacuum. The objections to this course were numerous: The weight and cost of such a holder (it must be capable of resisting external pressure); the large counterbalance weights to be moved when any change of pressure was desired; and friction, which would cause a large difference in the pressure thrown as the holder moved up or down. As a matter of fact, such a holder was finally installed, but simply because the alternative scheme seemed to offer greater difficulties.

As the alternative scheme was not adopted, no useful purpose would be served in describing it in detail. The arrangement of the three units—cooler, exhauster, and holder—was the same, but the holder was an ordinary pressure one. In this arrangement a vacuum was obtained at the top of the retort (during the blow only) by means of a subsidiary off-take connected to the exhauster inlet. The vacuum on the exhauster inlet was maintained by a retort-house governor placed on the holder connection.

Certain changes in the design of the generators and connections would have obviated some of these difficulties; and I have not the slightest doubt that, if the contractors who built the generators had had the order for the condensing and exhausting scheme at the same time as they had the order for the generators, these changes would have been made. When they designed the generating plant, they had no idea what type of exhausting plant would ultimately be put in. The delicate adjustment of pressures is a much more important and difficult matter in intermittent mixed gas manufacture than in the more direct case of coal gas; and the job should have been viewed as a whole, instead of, as it was, in two distinct compartments.

As I have said before, the procedure ultimately adopted was to instal a relief holder designed to throw to a 4-in. vacuum. The gas is taken from the generator wash box to a Lymn washer, whence the stream divides. During the run, part goes to the exhauster, part to the relief holder. The exhauster, being set to run at a constant rate, corresponding to the average rate of make, pulls the distillation gas from the generator during the blow period, and makes up the deficit from the relief holder.

The exhausting and cleaning plant is exactly similar to that supplied by the Power Gas Corporation with their producer installations. Though well known to producer men, this system of cleaning is not so familiar to the town-gas industry. Hence it will merit a more detailed description. The Lymn washer is a static machine, and consists of a vertical cylindrical shell with a central stationary shaft on which is mounted a series of inverted saucers. Alternating with these saucers is a series of truncated cones fixed to the outer shell. The gas enters the washer at the bottom, and on its passage upwards comes into intimate contact with the descending water, which passes from saucer to cone and *vice versa* on its way down. The gas finally passes through a set of wire-drawing screens, something like those in a "P & A" extractor, only stationary, and makes its exit at the top. The cooling water is circulated, being passed over a water-cooling tower, and returned to the Lymn washer. The cooling is very efficient, the tar separation good, and no reduction in calorific value occurs.

The exhausters are in duplicate and of the rateau-turbo type as built by Messrs. Bryan Donkin. They are driven by direct-coupled two-stage De Laval turbines with three nozzles, two of which are controlled by nozzle valves. A water spray, directed on the vanes of the exhauster impeller, serves finally to wash the gas and remove the last traces of tar. This final tar extraction is remarkable. In the outflow the tar and water are completely separated, and the first sign of tar has yet to be seen in the purifiers.

In view of the advantages of direct cooling and washing, the uncertain state of the residuals market, and the comparatively small annual consumption of coal, it was not thought wise to do anything in the direction of ammonia recovery. However, connections have been left on the inlet side of the Lymn washer for an ammonia absorber, and ground space has been earmarked for a direct-recovery plant. The whole of the condensing plant just described was supplied by Messrs. Ashmore, Benson, Pease, & Co., and erected by them on foundations prepared by the department.

Details of the Gas Generators.

The generating plant was succinctly described in the "Gas Journal" for March 26, 1924, and in a subsequent brochure by Mr. N. E. Rambush, M.I.Chem.E., the Chief Engineer of the Power Gas Corporation, Ltd. Doubtless you have all read the article referred to; and I would here like to take the opportunity to confirm publicly all his statements of fact. He, if any man, deserves the credit of bringing the vision of partial gasification by intermittent internal combustion methods to material fruition. The idea is one thing; the realization of it in practice another. Only an intimate knowledge of the principles involved, and a painstaking attention to details of design could have made those generators a success; and from one point of view a success they assuredly were.

It would be impossible in the time at my disposal to give a complete description of the generating plant; but the following remarks may serve to give a clear impression of its general features. In appearance it is somewhat like a glorified Tully apparatus; the outstanding difference at a casual glance being the coke-extracting mechanism. The plant is housed in a building very similar to a vertical retort house; in fact, the same building has since been extended at the same height and breadth to accommodate a Woodall-Duckham setting. Including the floor level, there are five working stages. These are:

(1) The bunker stage, to which the coal skips are elevated, and where they are tipped into the bunkers.

(2) The operating stage, on which are placed the operating levers, gauges, &c., and the coal feed mechanism. This stage is level with the top of the retort, and rodding holes are provided here to shake-up the charge when desired.

(3) The wash-box stage, which carries the wash boxes and the valve-actuating mechanism.

(4) The clinkering stage. Three clinkering doors are provided in each of the two generators, and also three sets of poke holes at two different levels, for the purpose of easing the fuel bed and examining its condition from time to time.

(5) The coke stage. This is at ground level, and here the coke discharges into skips through Glover-West extractors.

The firebrick lining generally is similar to that in a Tully machine, with the main difference that below the level of the fire-door sill the brickwork is coned-in to accommodate the extractor. A blast ring is carried round the whole circumference above the level of the top of the extractor, open on the one side to a cast-iron branch on the side of the generator, and on the other to a series of nostrils equally spaced round the inner circumference. This channel conveys the blast to the fire, the steam on the up run, and also the gas on the down run if required. A similar channel runs round the top of the generator (*i.e.*, the bottom of the retort) connecting the top of the generator with a vertical conical flue surrounding the retort. Provision is made for the admission of secondary air at this channel. The space between the outside of the vertical flue and the shell is occupied with a kind of framework of built-in tiles, which serve to support laterally the interior flue and retort, as well as effect their primary object of heat exchange. This space is divided into two sections by vertical partitions arranged on one diameter on each side of the central flue in such a way that the blast gases, after passing up the central flue, pass down one side of the framework, cross over near the bottom of the retort, pass up the other side, and finally make their exit at the stack. The steam superheaters are also arranged in this space. They consist of U tubes protected against actual flame contact, and are connected to distribution castings in the crown of the apparatus.

The blast, gas, and steam connections require no description, being as one would expect to find them, having regard to the fact that the wash box is on one of the higher stages. Both up-run and down-run pipes are sealed below water level with hinged flap valves connected to levers on the operating stage. A "distillation" valve is fitted to the up-run pipe above the level of the water in the wash box. This serves for the exhausting of the coal gas formed during the blow—the period during which both up-run and down-run gas valves are shut. The gas

outlet pipe is taken through the bottom of the wash box up to the water level, thus serving the double purpose of gas off-take and water overflow.

DOWN-RUNNING CONDEMNED.

The wash box is very efficient. Unlike many similar pieces of apparatus, it is of ample size; the large quantity of water keeping the off-take pipes constantly under seal. The difficulty due to the first rush of gas practically emptying the wash box cannot occur. It is fitted with a sloping side and apron, which facilitate cleaning. Again, the overflow serves to keep the foul main clean. That was to me one of the surprises of the plant. Beyond the wash box there was no trouble at all with solid deposits in any of the pipes. A more accurate knowledge on this point would have saved a vast deal of anxiety at the time of the design of the condensing plant. When the generating plant was shut down, after twenty months running, all connections beyond the wash box were as clean as on the day they were put in. Down running might have made some difference in this condition. I have heard the down run blamed for choked pipes in similar plants. But the up-run off-take pipe (the down run was not used) used to choke for the whole of its length from the top of the retort to the point where it dipped into the water in the wash box, proving conclusively that immediate and efficient washing is a *sine qua non* in this method of gas-making.

Both the generators were equipped for down running, but the down run seemed such a foolish proceeding that it was never seriously considered. In ordinary water gas practice the down run is, to put it somewhat loosely, simply to keep the fire in the right place, continuous up blowing and steaming tending to push it ever up and up. It was expected that the continuous extraction of coke would have a similar effect to that of the down run, and such indeed proved to be the case. It was urged at the commencement of the plant that down-running (the steam going into the top of the retort) would help to keep the coal on the move if it showed any tendency to hang up. Fortunately there was not an excessive amount of trouble from this cause, and the down run was discarded with relief. There is always the risk of explosion with it, however carefully the levers are interlocked. Again, the problem of supplying sufficient heat to the retort to ensure the proper distillation of the coal is a bad enough one in any case, without making it worse by using a method which periodically reverses the direction of the heat flow and cools the retort. And coal gas, laden with tar fog, cannot be pushed through a fire without making naphthalene. Not a trace of naphthalene has been discovered in the gas made in these generators consistently using the up run.

The gas-making cycle finally settled on was a 6-minute one consisting of 1½ minutes blow, ⅘ minute purge, and 4 minutes run. This cycle seemed to give the best results for efficiency and calorific value combined. The secondary-air lever was not employed, as the blast gas analysis was good without it. Its use would have caused a reduction of the air passing through the fire, without any corresponding advantage, as the very slight amount of additional heat transmitted through the wall of the retort due to its employment would have had no appreciable effect.

TESTS.

It is a matter for regret that extended tests for a period of at least a complete financial year could not be made on these generators. The opportunity was phenomenal in the writer's experience, and very valuable figures could have been collated. As the whole of the gas was being made by this method, the technical results could have been more or less checked by the balance-sheet, and whatever individual conclusions were drawn, the main outlines would have been easily verifiable and above suspicion. But there was little time for accurate work. Rough and ready tests were made in the usual routine; but such tests, though good enough sometimes as a guide to plant operation, are better left severely alone when it comes to drawing accurate conclusions. However, enough information is available to form a fairly accurate estimate of the value of the plant as a manufacturing unit complete in itself. It is as this that I shall endeavour to judge it. As an auxiliary unit its value would be simply a question of circumstances, and I have no doubt that it could more than hold its own against such rivals as blue or carburetted water gas or any other system of internal combustion gasification short of the producer gas method.

The premises on which it is proposed to base the following remarks come under three headings. Many of the conclusions are drawn from a combination of these premises, and it is not proposed to treat them entirely separately. They are:

(1) The actual guarantee test run in January, 1924.
(2) Results obtained for the months of January and February, 1924.
(3) General results based on operating experience.

The technical figures are those compiled by Mr. Rambush, and published by him in the article previously referred to. I have taken the liberty of including them in an appendix.

First as to the guarantee test. This was a 24-hour test with a flying start, and was conducted with the most scrupulous care. The plant was operated by the Council's workmen under the direct supervision of the Contractors' Engineer, with no interference whatever from the gas-works technical staff. The station meter had been tested, and the overflow sealed at the time of its erection, and very little gas had passed through it up to the time of the test. Temperatures at the meter were taken hourly, and the gas volume was corrected accordingly. The calorimeter readings were taken by the clock, three every hour for the whole period. One test alone was rejected, because of an error made in switching the water overflow. Each test was made by a representative of both sides, one operating the calorimeter and the other entering the results and making the calculations, the men changing places periodically. The calorimeter used was a Boys, and the formula as laid down by the Gas Referees was rigorously followed. The average of 71 tests was used in preparing the final statement.

I lay particular stress upon this test. As I have said, it was most carefully conducted. True enough, the average value included some rather low readings, which might easily have been higher, but the same kind of thing is surely more likely to happen in ordinary operating, when there is no continuous chemical observation. The Contractors were out for all they could get. Unlike some Contractors I have met, they knew their job; and I do not think that anyone will seriously disagree with me when I say that a gas-works manager who in his daily routine approximated to results obtained under such conditions would think he was doing remarkably fine work.

Judging by results that have been reported now and again in the Technical Press—results as to makes and values—it would seem that a mixture of coal gas and water gas made in the same vessel had a virtue possessed by neither of these gases separately. I mean, that if such reports are reliable, the calorific value of the mixture is for some obscure reason greater than mere arithmetical calculation would suggest. Is such an idea borne out by the results of this test? Analysis and coke consumption point to the mixture made being nearly half-and-half coal gas and water gas. The analysis itself points to a slight excess of coal gas. The make was (corrected to G.R.A. conditions) 28,910 c.ft. per ton, and the calorific value 396, corresponding to a gas output of 114 therms. Allowing a coal gas output of 70 therms, we are left with a water gas output of 44 therms, which, at 300 B.Th.U., corresponds to a water gas make per ton of coal of 14,650 c.ft. From the coke standpoint, the water gas made figures (on the basis of 32 lbs. per 1000 c.ft.) about 14,380 c.ft. In other words, the results of the test are consistent with:

(1) A thorough distillation of the coal.
(2) That the value of the gas made is approximately what one would expect on arithmetical grounds.
(3) An increase in the make per ton above about 29,000 would be bound to mean a decrease in calorific value.

AND SOME DEDUCTIONS.

Item (3) is not quite so self-evident as it would appear at first sight, depending to some extent upon (1). It is always possible that, starting with a certain mixture of gases, an increase in water gas might mean a more perfect distillation of the coal, and hence an increased make accompanied by an enhanced value. In fact, general considerations of the process as a whole point to a critical mixture which gives a maximum value. This is confirmed by experience.

Regarding (1), if coal had been getting-down into the water gas zone, evidence of such a condition would have shown at the stack during the blow. In subsequent operation it very often did get lower than was desirable, sometimes even appearing at the extractor; but there was no trouble on this score during the test. To me at least, the big surprise of the plant lay here. Everyone knows the difficulty of obtaining through distillation in complete gasification machines without some form of regenerative circulation; and yet here was a machine gasifying only one-third of its coke, and apparently supplying sufficient heat to distil the coal in a superimposed retort. What was the explanation? It was certainly not due to the external heating of the retort. The diameter of the retort precluded this, and in any case no secondary air was used in the chequer work at any time, the intention being to keep the temperature at the top of the retort at a minimum.

Later on, it was frequently observed that under certain conditions an extremely hard core of coke extended from the base of the retort almost to the point where the blast entered the base of the fire. This core was roughly cylindrical in shape, about 2 ft. in diameter, and solid. The surrounding ring of coke was loose, except at the lower levels where the clinker formed. The space immediately below the upper ring of nostrils was frequently void. Everything pointed to events inside occurring in some such way as this: The outer ring of coal in the retort was first distilled owing to the tendency of the water gas to hug the sides, and to a certain extent because of the external heating. As the charge moved downwards this ring broke-up, falling into a larger ring in the generator; the centre of the retort charge moving bodily down. The air and steam, in their passage through the generator, followed this outer ring of very loose coke, leaving the central core practically untouched. In effect, a wall-less retort extended down through the hot fire zone. That there was a plastic mass inside this core was frequently proved. Sometimes the gas formed by this mass escaped with the blast products; sometimes it did not. Perhaps this accounts for the good distillation results and also for the low percentage

of CO in the blast products. As a guess, the idea may be worth something.

Regarding (3), the slack assumption that a calorific value much above 400 may be obtained by the simple expedient of reducing the water gas made has not been confirmed. From the very commencement of operation the difficulty encountered was not with the make per ton, but with the B.Th.U. per c.ft. Everything was done, short of actual regeneration, to increase the value; and the conclusions ultimately arrived at were: That a mixture about half-and-half coal gas and water gas gave the maximum value, any increase or decrease of steam tending to decrease this value. That under careful chemical supervision the value could be maintained with difficulty at an average of 400 B.Th.U., though tests of 3 or 4 hours' duration seemed to indicate that 410 B.Th.U. might be reached if all factors were under thorough control; but that, without continual tests on the blow and make gases, and in ordinary plant routine, even 380 B.Th.U. would be a value difficult to maintain. The value was ultimately declared at 375 B.Th.U., and subsequent events proved the wisdom of this. In this connection regeneration, though suggested, was not seriously considered, on grounds of additional expense and complication, and the loss in capacity entailed.

An Extension Required.

The generating plant as existing in January, 1924, though large enough to carry the ensuing winter's load, did not provide sufficient reserve in case of accident. An extension scheme had to be devised, and, if possible, erected before the dark days set in. As no time could be lost, this matter was gone into as soon as a month's working results were available and sufficient data obtained to form an estimate of the position. The crux of the question was simply whether the existing plant should be duplicated (with certain alterations shown to be advantageous by experience), or a setting of ordinary verticals put up.

Doubtful Case for Low-Grade Gas.

The calorific value finally to be aimed at naturally required most serious consideration. It was recognized that the therm today is in its most valuable form in the shape of gas, and that, *ceteris paribus*, the lower the value the better. Scunthorpe was an ideal place in which to try a really low-grade experiment. In the writer's own experience gas had been distributed at values of 300 B.Th.U. and lower, and a constant value of 350 B.Th.U. with few inerts would have given the old consumer better satisfaction than the complex of inerts to which he had been accustomed. But it would be idle to say that the consumers as a whole were satisfied. Those who had come from other towns were very vocal in their complaints. Even with 375 gas the adjustment of certain appliances was difficult, and lighting, to be a success, had to be confined to medium and bijou mantles.

It was felt that, whatever the technical aspect, the consumer with his own somewhat hazy notion of "good" gas must be thoroughly satisfied, if business was to prosper. Education was all very well, but it could not be pushed beyond certain limits. The average housewife thought more about the time her kettle took to boil than about the efficiency of the heat exchange, and would sooner have a sooted pan than have a burner perpetually liable to strike back.

A question of much greater importance than the actual value declared, is the maintenance of that value within certain limits. The lower the value the more important its constancy becomes. And unfortunately I have found it almost impossible to maintain a reasonably constant value of 375 with the process just described. Values have been taken as low as 340, and as high as 430 B.Th.U. This would not matter so much if gas mixed, as it ought to do, in the holder, so that the consumer got the average. It seems an unscientific kind of thing to say, but my experience is that if you make gas into the holder in patches it will come out in patches; and the consumer gets the benefit of the change.

This is the first serious criticism of the plant. Of course, it would not apply to anything like the same extent if the machine was used as an auxiliary, and especially if the gas was stored in a relief holder and carefully admitted into the main stream. I am aware that I am laying myself open to the charge of careless operating by quoting the above figures. But, in extenuation, I would ask you to remember one or two facts about the process. First, it is a dual process involving two wholly distinct kinds of gasmaking in the one vessel. Unlike carburetted water gas practice, which is also a dual process, there is no sharp cleavage between the stages, enabling one to isolate faults; secondly, a water gas fire is a very delicate system, and not likely to be improved by having its fuel dumped upon it in irregular lumps; and thirdly, the process, to be a practical one, must be worked strictly to the clock—a system which makes no allowance for such erratic happenings as hanging-up and clinker. Again, it is a blind process; and the first evidence of trouble is very often the trouble itself.

All things considered, it was thought that a value lower than 400 B.Th.U. should be avoided, and that the extension would be better if it were capable of rising considerably above this. Add to this the fact that the existing plant could be worked with greater ease and efficiency at a value somewhere in the neighbourhood of 350 B.Th.U., and the inevitable conclusion was that, unless the difference in capital costs was prohibitive, the extension should take the form of retorts. A retort setting could be used to make a gas as low as 425 B.Th.U. if desired, if used alone. Alternatively, in conjunction with the existing plant operating at 350, a value of 425 B.Th.U. could be easily maintained with reasonable efficiency and flexibility.

Retorts v. Generators.

To arrive at the approximate difference in costs between the two systems, a comparison was made based upon quotations received for the extension. Messrs. Ashmore, Benson, Pease, & Co. quoted for a plant similar to that already existing; Messrs. Woodall-Duckham for a setting of eights. Both plants quoted were capable of 650,000 c.ft. per day. The probable operating costs were obtained on the one hand from our own figures for January, 1924, and on the other from a seven days' test made at Market Harborough on a retort setting similar to that offered. As, for financial reasons, the difference in cost for the next year or two was more important than the difference over an extended period, the unit figures were based on a make of 300,000 c.ft.—that being the probable immediate output of the extension. The comparison is as follows; the make is 300,000 c.ft. and the cost is in pounds per day:

Woodall-Duckham Vertical Retorts.

Coal, 16·46 tons at 28s. 6d.		£23·45
Labour		2·20
		25·65
Credits—		
Coke, 10·356 cwt. per ton at 30s.		12·78
Tar, 15 gallons per ton at 4d.		4·11
		16·89
Net operating cost		8·76
Interest at 5 p.ct., and repayment of capital—		
£3500 at 25 years	£248	
£10,000 at 15 years	962	
	1210	3·32
Repairs and maintenance		0·27
		£12·35
Total therms made	1455	
Cost per therm	2·04d.	

Internal Combustion Generators.

Coal, 10·52 tons at 28s. 6d.		£15·00
Labour		2·20
		17·20
Credits—		
Coke, 1102 lbs. per ton at 31s.		7·76
Tar, 14·06 gallons per ton at 4d.		2·46
		10·22
Net operating cost		6·98
Interest at 5 p.ct., and repayment of capital—		
£4500 at 15 years	£432	1·18
Repairs and maintenance		0·27
		£8·43
Total therms made	1180	
Cost per therm	1·71d.	
Equivalent cost for	1455 therms	£10·38

These figures are not to be regarded as a complete statement of costs. They merely include the main items of difference between the systems, with the notable exception of steam. As the steam plant (including the blowers) was working very inefficiently at the time, it was not thought fair to the new plant to include the boiler fuel used directly; but a generous estimate was made which showed a comparative credit to the retort plant of £1·25 per day. Including this in the previous statement, the difference in cost per day for an output of 1455 therms was £0·74 in favour of the internal combustion system—*i.e.*, about 0·12d. per therm. It was thus obvious that, even under the peculiar conditions existing at the time, there would be no appreciable financial saving in keeping to the existing system. But, in drawing general conclusions as to the relative costs of the two methods, there are other factors to be taken into consideration; and these factors tell very heavily on the side of the older fashioned method. The comparison quoted was based on the simple extension of the mixed gas plant. It did not include for house and blowers. On the other hand, the retort cost included a house and waste-heat boiler; it was in fact a complete new plant. Basing the charges on a make of 300,000 c.ft. showed the retorts at an unfair disadvantage, because the big difference between the two lay in the capital items. Doubling the make, of which both alternatives were capable, would halve the respective capital charges per therm. I am of opinion that better fuel was used at Scunthorpe than in the comparison test at Market Harborough, though I would not lay too much stress on this point. Practically the whole of the fuel used in the generators during the month under consideration was Wath Main, with an ash content of about 4 p.ct., and one of the best and most uniform gas coals I have ever come across. The coke made by the new method, though the weight

was there, had a very high percentage of breeze. It was frail, and did not stand up to the shock of the screens. Its appearance also was against it; and this, though it does not necessarily affect its heating value, most certainly affects the price obtainable. Finally, the fact of having retorts and producers entirely separate allows much greater freedom in selecting suitable coals, as their gasmaking and coking qualities do not affect each other to the same extent.

W.-D. VERTICALS INSTALLED.

These considerations led to the final adoption of a setting of Woodall-Duckham verticals of the latest pattern. That the decision was the right one was conclusively proved in the subsequent year's work, when generator gas alone was supplied to the town. The results tabulated in the appendix have only one meaning. The year's complaints, though very much fewer than previously, were still fairly numerous. Since the verticals have been at work, these complaints have been reduced to practically *nil*, and maintenance troubles have almost disappeared.

In these remarks I have endeavoured to be as impartial as possible. In fact, any mental bias that I had at the beginning was in favour of low-grade gas, not on thermal efficiency grounds, but simply because the therm is, and is likely to be, worth more money in the form of gas than in any other form. But the necessity for satisfying the consumer, with the endless items, technical and psychological, that go to attain that end, the continual difficulties in maintaining a reasonably constant value of generator gas, and the final balance-sheet, which told no uncertain tale, have settled, in my mind at least, that in present circumstances the more conservative method is the better.

In conclusion I would like to repeat most emphatically that I have not considered the Scunthorpe method of making gas as an auxiliary to other apparatus. There it should have a large field. The cheap power and exhaust steam available in many large works would cheapen the process enormously. It has the advantages of blue and carburetted water gas in the matters of capacity per unit area and ready response to sudden variations in demand. Unlike these methods, it avoids the double handling of coke, and the gas is cheaper per therm produced than in either case, especially carburetted water gas. It is, on the other hand, more difficult to operate scientifically; but a slight reduction in the calorific value demanded, and certain changes which, I believe, the builders have in hand, should reduce this difficulty in no small degree.

APPENDIX.

Guarantee Test of Internal Combustion Generators.

COAL ANALYSIS (DRY) WATH MAIN.

Ash	4·1 p.ct.
Volatile matter	35·1 ,,
Total carbon	77·1 ,,
Hydrogen	6·2 ,,
Calorific value	13,420 B.Th.U. per lb.
Gas made	329,400 c.ft. at 29·66 in. bar., and 43·6° Fahr.
Gas made at N.T.P.	316,700 c.ft.
Gas yield per ton of coal	26,960 c ft. (N.T.P.)
Coke made	5 tons 4½ cwt.
Coke made per ton	996 lbs.
Calorific value	424·46 B.Th.U. gross (N.T.P.)

MEAN ANALYSIS OF GAS.

	P.Ct.
CO_2	4·7
C_2H_4	1·6
CO	28·1
H_2	50·7
CH_4	13·0
N_2	1·9

Calorific value (calculated), 435 6 B.Th.U. gross (N.T.P.)

Results for January and February, 1924.

YIELDS PER TON OF COAL TREATED.

Coke	1114 lbs.
Tar	15·8 gallons.
Gas	28,500 c.ft. (G.R.A.)
NH_3 (not recovered)	35 lbs. sulphate.

MEAN GAS ANALYSIS (JANUARY AND FEBRUARY.)

	P.Ct.
CO_2	6·9
C_2H_4	1·65
CO	25·55
H_2	50·65
CH_4	12·1
N_2	3·15

Gross calorific value (calculated) N.T.P., 418·8 B.Th.U.
" " " " G.R.A., 390·6 B.Th.U.

TYPICAL BLOW GAS ANALYSIS.

	P.Ct.
CO_2	16
O_2	0·5
CO	4·0

Results for the Year ended March, 1925.

Gas made (G.R.A.)	117,662·7 M. c.ft.
Coal used in generators	3953 tons.
Make per ton	29,765 c.ft.
Coke made	1,284 tons.
Coke per ton	6·5 cwt.
Tar made	52,574 gallons.
Tar made per ton	13·3 gallons.
Fuel used in boilers—	
Coal	2,021 tons.
Coke	411 tons.

It was estimated that three-quarters of the coal fired in the boilers could be legitimately charged to the generating system, hence :

Total coal for gas making	**5,468 tons.**
Make per ton (total fuel)	**21,517 c.ft.**

Discussion.

The PRESIDENT (Mr. F. Prentice, of Ipswich) said they had with them Mr. Rambush and Col. Peebles, and he would ask them to open the discussion.

Mr. N. E. RAMBUSH (Chief Engineer to the Power Gas Corporation, Ltd.), after having expressed his thanks for the invitation to attend the meeting, remarked that what Mr. Simpson had said in his paper had been put very fairly indeed. With regard to condensing plant, it had to be borne in mind that this was not based on standard practice. He thought the author was to be congratulated upon having tried something quite new in this respect. His assurance that no reduction in calorific value occurred was very much to the point, because if this was proved also to hold good in other places, it would mean that condensing plant for treating distillation gases could be re-designed so that the cost of installation would be brought down to at least one-half of what it was at the present time. This would be well worthy of consideration by the gas industry. The author alluded to the elimination of the down-run and of the secondary air as being self-evident; that was not quite the case. Various experiments and tests at hourly intervals over several days had shown that neither down-run nor secondary air was of any advantage whatever. It was the result of actual working tests that had brought them to operate on these lines. During 3½ months that the plant was in operation continuously under his firm's supervision, they had three men there, one per shift, of the ages of 18, 20, and 27 respectively; and the calorific value of the gas fluctuated between 400 and 375 B.Th.U. He believed that when those results were not obtained it was not because his firm's supervision was better (none of their men having seen a gas-works or water gas plant before), but because the plant was not worked continuously. The author's conditions of operation at Scunthorpe had been that the generator had been shut-down every 24 hours. This policy was dictated by the fact that during the summer the demand for gas was not sufficient to justify the running of the plant continuously. Could this have been arranged, there would have been no need for clinkering—indeed, his firm found the best result under continuous operation was with clinkering once per month. With intermittent running, it would always be found after stand-by periods that the calorific value dropped; and he believed this was at any rate to some extent responsible for what Mr. Simpson had found in practice. With regard to the author's decision to instal the new plant referred to in the paper, and not a repetition of what was installed in the first instance, of course his firm were sorry about this at the time. He thought the decision was a fair one to come to in the circumstances of the case; but he would like to point out that, in making the comparison which Mr. Simpson did, he referred to the "older-fashioned method." This was hardly right, because the verticals which the author had now installed were the most modern development of long years of gas retorting practice; whereas the plant his firm had put up at Scunthorpe was the first introduction of a new gas producing system. Had the firm an opportunity of erecting another plant to-day, it would be somewhat different, and weak points that had been found in it would be eliminated. Coming finally to the results for the financial year, they would all realize that an important point to be considered was the coal used under the boilers. The author said that had the firm had the order for the condensing and exhausting scheme at the same time as they had the order for the generators, they might have built the plant in a different way. Certainly they would. But they did not know also what the boiler plant would be. He remembered before the contract was signed recommending the Engineer to instal waste-heat boilers and steam accumulators. If this had been done the uneconomical results would largely have been avoided.

Col. W. CARMICHAEL PEEBLES, D.S.O., thanked the Association for their invitation to attend the meeting; remarking that it was always a pleasure to hear such papers, and the discussions upon them. The author had been very modest in all that he had said. He knew many of the difficulties that Mr. Simpson had gone through in getting things into shape. With regard to the station governor to which brief reference had been made, he thought the author was very largely induced to go in for this governor from experience in the United States, where automatic self-loading governors were very largely in use. Mr. Simpson knew its limits; and one was the difficulty of the change of pressure affecting the discharge through the valves. The Connelley people had got over this difficulty by putting in front of the automatic governor a station governor throwing a constant outlet pressure. This, however, did not do when one had changes in outlet pressure. After a lot of discussion, they hit upon the differential pressure governor. The ideal all engineers had in mind was to give as nearly as possible a constant pressure to the consumers; and this automatic governor had the effect of giving a constant pressure at any desired point on the system. One might select half-a-dozen points, and say that here there must be as nearly as possible a constant pressure. Then one could take these points together and get an average; and, once set, it would remain practically at that figure. In reference to the invention made by Mr. Leather a good many years ago, the two governors were shown combined in one; but this new invention was extremely simple and get-at-able. When they got this thing perfected, he sent the drawings to Mr. Leather, and had a congratulatory letter in reply. When he received a letter from Mr. Simpson saying that his governor acted like a charm, he was very pleased. The "finger-tips" of his district were now supplied with a reasonable pressure of gas.

Mr. R. G. SHADBOLT (Birmingham), congratulating the author of the paper, remarked that he had apparently set out with a certain amount of doubt. He might certainly disabuse his mind of any sense of failure, for he had produced a most useful paper. The Asso-

ciation had already had papers from Mr. Moore, which were really forerunners to this one, which depicted actual working experience and enabled them to visualize the results obtained, and compare them with the particular process with which they might be specially familiar. He had very much the feeling now that he had when it was originally brought forward—that this plant was more or less of a hybrid, trying to achieve something between ordinary carbonization and total gasification, and therein lay its weakness. There appeared to him to be nothing at all different from what had already been realized in so-called total gasification plants so far as they were comparable. One fact brought out by the author was that he had done away with down runs on account of the increased quantity of fuel passing down the generator, and its cooling effect. Under these particular conditions, that might be quite correct; but it did not apply to the water gas plant or to the ordinary total gasification plant, because in these one had a smaller amount of fuel for a given gas yield. The author told them there was a kind of critical maximum with regard to yield; and this he could understand, as to calorific value. One might be surprised at times, if it was expected to obtain a higher calorific result by using a better quality of coal, to find that the calorific value was the same, but there was an advance possibly in the total heat secured—*i.e.*, in the total number of therms obtained. He was not quite sure whether Mr. Simpson intended to use this as an auxiliary plant. If he did, he might find that to go on to total gasification would be an equally, if not more, economical proposition. At present there was 6¼ cwt. of coke remaining per ton of coal used; and this was not like 6½ cwt. from ordinary retort working. It was coke which had had extracted from it a certain quantity of carbon, and must be poorer to that extent; while the ash from this coke must be increased proportionately. The breeze was another factor; and the tender nature of the coke, though he had not altogether anticipated it. One interesting feature to him was this column of partly carbonized coal in the centre. This, again, was due entirely to the attempt to make coke by using bituminous or coking coal. In a total gasification plant, if one mixed a proportion of coke with a certain proportion of bituminous coal—anywhere from about one of coke to nine of coal, up to about three or four of coke to five or six of coal, according to the coking properties of the coal used—this would overcome the caking propensity of the fuel, as it issued from the mouth of the apparatus more readily, and broke up in so doing; but the real cure was to use non-bituminous coal. It was the caking of this column which drove the steam round the outside instead of through the fuel. Designers of recent years had taken measures to ensure that the blast would be sent up the centre and through the general body of the fuel bed. These were all factors which to his mind went to show that this plant was a "half-way house" between one form of gas making and another; and as such it fell between the two stools. If those in charge of the plant continued right on to complete gasification, he felt sure they would totally gasify the coal as effectively, if not more effectively, than under present practice; and the total calorific yields would be quite equal to those given. Mr. Simpson rather emphasized the maximum efficiency point; but if they looked into his yields they would see that he got about 114 therms per ton of fuel. He had also 6½ cwt. of coke per ton of fuel left. If this were made into water gas, and added to the remainder before extraction of the residue from the generator, what would be his yield? It would be practically the same as was obtained by ordinary total gasification methods. Calculating on the moderate basis of 175 therms as the total gasification result per ton of fuel through the generator, there remained to be produced from the 6½ cwt. of coke which he had on his hands some 61 therms, which was at much the same rate of water gas production as from the coke already converted into water gas. He did not, therefore, see the practical bearing of the maximum efficiency factor—unless they were bound to work that plant only, and had to keep the calorific value up to a predetermined standard such as indicated in the paper. In this he could imagine the maximum efficiency factor being of value; but he could not understand it being so when considering the total calorific yield from the fuel that was being used.

Mr. W. W. TOWNSEND (Colchester) said that when the first paper was read on this type of plant, he took it the object was to produce a gas in the neighbourhood of 400 B.Th.U. or over—an attainment very much sought after. Certainly, for a works below a certain size, it would be of great advantage if one type of plant could be evolved which would meet all demands. If one went in for a total gasification plant, it seemed that it would be necessary to have retorts as well. The problem was to produce a gas which was fit to distribute as made, without mixing; and he did not think there was any reason to say this problem had been finally disposed of, though a certain degree of success had been reached. It would be interesting to hear from the author the quality of coke produced. When so much attention was turned to the production of low-temperature coke by internal heating, rather similar to this, it would be useful to know whether the coke referred to by the author was to any extent the sort of stuff they were recommended to make. It must have been made by low temperature, and so presumably should have an added value for domestic purposes. Allusion was made in the paper to "G.R.A." and "N.T.P." He had always taken the latter to mean 30 in. mercury and 60° Fahr.; and this was what was referred to in the Gas Regulation Act. He had been interested to hear about the governor. It had often occurred to him that it would be of great value if they could know the output of gas per hour from their works. Under present conditions the figure was difficult to arrive at. Years ago he had had visions of a combined governor and integrator which would give on a chart the hourly output; and he certainly thought it would be possible to design such an instrument. As to mixing of gas in the holder, the author said that gas which was patchy going in was patchy coming out. This was not his (the speaker's) experience, which was that, if the gas remained a sufficient time in the holder, diffusion would take place. Working simply into and out of a holder, of course, the gas would not have time to mix thoroughly. Mr. Simpson, in one part of his paper, thought the general conditions showed that the coal had been thoroughly distilled; and he assumed that 70 therms of distillation gas per ton had been produced. The remainder of the paper, however, appeared to indicate that 70 therms of distillation gas per ton was not in accordance with facts, at any rate over a lengthy period. This plant was like a good many composite arrangements which attempted to do several things at the same time, and did not do any of them properly. With reference to the figures which the author put before them as to the cost of the new coal gas plant as compared with the extension of the other plant, he would like to draw attention to the fact that the coal used in generators in a year was 3953 tons, and the coal used under boilers 2021 tons. This proved what a good many of them had already discovered for themselves—that one must take very much into consideration the steam consumption, when comparing processes of this kind with others. He thought also, in view of this fact, that in comparing the two systems the capital cost of the boiler plant to raise all this steam should have been included. In the case of the verticals, boilers were included; with the other plant, they were not.

THE AUTHOR REPLIES.

Mr. SIMPSON, in reply, said that, with regard to criticism by Mr. Rambush of the proportions of gas made, he did not very well see how one could avoid the conclusions drawn from the analysis. It might be that one was wrong in attempting to draw a sharp line between the coal gas and water gas made; but it seemed the only possible way to approach the subject. He thought there was no doubt whatever that the difference between the test results and the year's results was mostly due to chemical control, and that such control, though it did not require an expert—anyone who could use an Orsat would do the job—yet required to be continuous. With regard to Col. Peebles's remarks, he believed that the variation in outlet pressures following on automatic governing had been lost sight of in many previous designs of such governors. Attention had been focussed to such an extent on the variation of inlet pressure, that the equally important variation (from the point of view of proportional governing) of the outlet pressure had not received the attention it demanded. He rather felt that Mr. Shadbolt had missed the point in his remarks about the efficiency of the plant. In Scunthorpe, the important thing was the calorific value; and all that was stated was that under certain conditions a maximum value was attained. When the day came to use the plant as an auxiliary—and he hoped the day would come soon—then efficiency would be the important consideration, and the solution would be very probably either complete gasification by intermittent methods or continuous producer working with the extraction of coke. The latter method would deserve serious investigation when the time arrived. Mr. Townsend had asked whether the coke produced was low-temperature coke. Well, he could not say—he did not know enough about it—but it was difficult to sell, and this, as far as he was concerned, was the main point. As regarded the nomenclature "N.T.P.," he himself at the outset was in some doubt as to what it should mean in the town gas industry. He even tried to persuade Mr. Rambush that it ought to mean 60° Fahr. and 30 in. mercury. But, undoubtedly, in all scientific and chemical books "N.T.P." meant 0° C. and 760 mm. mercury; and it was taken as such for the purposes of the contract. In the matter of the use of the governor as an indicator of the instantaneous rate of send-out, this had already been done. Pressure being proportional to send-out, a recording chart was easily marked to read rates direct. There was only one holder at the new plant, and patchy gas on the town could not be avoided, even though the holder connections were almost as far apart as they could be. Generally, he would like to emphasize that his remarks as to the mixture of gases made were based on the guarantee test when no coal was observed coming through the extractor, and not on the subsequent running, when such a condition frequently occurred.

Gas for a Tin Decorating Plant.—In connection with a large tin decorating plant at New York, it is stated by a periodical entitled "Blast Furnace and Steel Plant" that there was a recent scrapping of the coal-burning equipment, and installation of gas-fired ovens. In the first twelve months a saving in fuel of $1920 and in labour of $660 resulted, with an increase in production of 17 p.ct. As a matter of fact, the four gas-fired ovens were said to have paid for themselves in their first year of service.

"Pitman's Journal of Commercial Education."—Founded by the inventor of Pitman's shorthand in 1842, "Pitman's Journal," at first entitled "The Phonetic Journal," is about to become "Pitman's Journal of Commercial Education." Its aim will be to deal with all aspects of commercial education, and it will be the only weekly periodical of its kind published in this country. The change, involving an enlargement from 32 to 48 pages, will be made with the issue for Oct. 3, which will include special articles by leading authorities on subjects such as business economics, commercial history, commercial geography, secretarial practice, modern methods of business, psychology, commercial law, advertising and salesmanship, French, Spanish, German, typewriting, arithmetic, bookkeeping and accountancy—in fact, all the subjects of commercial, secretarial, and professional courses. This interesting journalistic development is a reminder of the increasing importance of commercial education as an integral part of the educational system of the country. As a commercial nation faced with intensified competition, it is essential for us to pay special attention to modern educational requirements of a specialized character; and "Pitman's Journal of Commercial Education" should play an important part in the world of educational publications.

CERAMIC SOCIETY.

THE Refractory Materials Section of the Ceramic Society held their Sixteenth Autumn Meeting in the rooms of the Chemical Society, Burlington House, on Wednesday and Thursday, Sept. 16 and 17—Mr. FRANK WEST (President) being in the chair. On Wednesday morning a series of papers was read, and in the afternoon the Annual Meeting for the election of officers, &c., was held. On Thursday, the Presidential Address was delivered, and was followed by other papers. Several representatives of the gas industry were present throughout, including Dr. H. G. Colman and Mr. J. P. Leather.

Wednesday, Sept. 16.

The first paper was "A Preliminary Note on the Influence of Foreign Matter on the Thermal Expansion and Transformation of Silica," by J. F. L. Wood, H. S. Houldsworth, and J. W. Cobb (Fuel Department, Leeds University). None of the authors was present; and the paper was presented in their absence.

The authors point out that the advantages resulting from a large conversion of quartz into cristobalite or tridymite during the kiln firing of silica bricks are generally recognized. Many users of such bricks determine, either directly or indirectly, the degree of conversion which has taken place during burning, by finding the true specific gravity or the after-expansion of the bricks, or by microscopical examination. The degree of conversion attained depends upon the nature of the raw material, the fineness of grinding, and the temperature and duration of the heating of the kiln. The fineness of grinding is limited by considerations other than the conversion of the quartz; and the economic factor is all-important in determining the extent of heating which is practicable in the kiln. Naturally, many workers have sought for a catalyst which would facilitate the conversion of the quartz, and so reduce the cost of burning; but on the whole the results obtained have been disappointing. In those investigations the degree of conversion attained was determined by microscopical examination, or from the specific gravity of the fired material.

It was thought that a determination of the reversible thermal expansion of quartzitic test-pieces, to which small additions of foreign matter had been made before burning, might yield better information as to the behaviour of such mixtures on heating than would the other methods of examination. It was hoped also that the work might suggest the mechanism of the changes produced by the materials added, and consequently furnish more exact knowledge as to the properties which a suitable accelerator should possess.

The preliminary experiments which are described in this note were made on a Welsh (Bwlchgwyn) quartzite, which had been ground to pass a 100 mesh I.M.M. sieve, so that the relative effects of the various substances added would be more evident than with coarser-ground material. The specimens were fired at cone 9, cone 12, and cone 14 for two hours before examination, and the results compared with those obtained for a standard test-piece containing 2 p.ct. of lime. The true specific gravities, porosities, and refractoriness were also determined. The differences in the specific gravities of the substances were so small that from these determinations alone it would be concluded that few of the materials added had produced any effect on the degree of conversion of the quartz, and that even in the most favourable mixtures the acceleration of the inversion of the quartz was extremely small.

The reversible thermal expansion of the samples, however, showed that in some cases pronounced changes had occurred as a result of the additions, though the density determinations did not indicate such a result. When 2 p.ct. of boric acid was used, and the test-piece fired to cone 14, there was no evidence of the presence of unconverted quartz, though the density was 2·39. The results obtained with quartzite *plus* 5 p.ct. of boric acid were more striking. Not only was the rate of transformation of the quartz accelerated, but the expansion showed that the cristobalite present was small. No expansion due to tridymite was detected, yet the total expansion from 15° to 300° C. was only 0·74 p.ct. after burning at cone 14, though no quartz remained in the test-piece. This would suggest that a considerable part of the quartz had been taken into some form of solution, solid or otherwise. On burning at cone 18, the expansion from 15° to 300° C. was reduced to 0·35 p.ct., suggesting that some of the cristobalite formed at the lower temperatures had now been taken into solution. These effects were intensified when the boric acid was increased to 10 p.ct., the quartz and cristobalite present after burning at cone 12 being very small, while a regular expansion was obtained after firing at cone 14.

The addition of 2 p.ct. of potassium carbonate, potassium chloride, potassium chromate, biotite, sodium felspar, ferric oxide, ferric chloride, and ferrous silicate assisted the transformation of the quartz; and here again it appeared that some of the quartz transformed was retained in some form of solution. Lithium chloride and magnesia also accelerated the inversion of the quartz. An increase in the lime content up to 6 p.ct. did not produce any marked change in the degree of conversion.

It was thought that the addition of cristobalite might be helpful in determining the form of crystallization of any silica taken into solution, but the addition of 5 p.ct. of cristobalite to the specimen containing lime did not accelerate the conversion of the quartz in any way.

The behaviour of specimens prepared from finely-ground Deepcar ganisters and 5 p.ct. boric acid was similar to that of the Welsh quartzite. The refractoriness was lowered from ½ to 2 cones by the addition of the materials used. In some cases the effects would probably be more pronounced on the refractoriness under load.

The effect of the more promising materials used in this investigation, as well as that of natural borates, on the reversible thermal and on the after expansion, is to be determined for graded samples of quartzite, and the extent of the volatilization of the materials used during burning will also be found.

Discussion.

Dr. J. W. MELLOR stated that there were some interesting side-issues which arose from the paper. The first one was the determination of the amount of conversion in silica bricks. He would suggest that there was no reliable means of estimating the amount of conversion. The usual method was to cut a section across the material, and judge from the areas of crystobalite and quartz and tridymite what had taken place. There was a certain amount of chance, however, as to what the particular section might be, and whether there was much conversion or otherwise. Furthermore, it was difficult to determine under the microscope whether one was dealing with tridymite or crystobalite; and he very much doubted if any man could tell which was which with a straight section cut through the material. He was glad to know, therefore, that Prof. Cobb had taken another property of materials—namely, irreversible expansion.

Mr. J. P. LEATHER said it seemed to him that the method of specific gravity had apparently been turned-down. What did the authors mean by saying that the specific gravity showed nothing at all, and yet came to the conclusion that there was considerable conversion? Moreover, he did not understand the reference to solid solution, and generally speaking a great deal more information was required.

Dr. MELLOR remarked that an experiment by Campbell had shown that unsatisfactory results were obtained with the specific gravity test. Personally, he had always taken it that the specific gravity gave one of the best criteria of the amount of conversion; but when dealing with a composite material, and with, for instance, 2 p.ct. of boric acid mixed with the material, the whole of the expectations on the subject were upset.

LOW-TEMPERATURE BURNING OF STOURBRIDGE FIRECLAY.

Mr. C. E. Moore, in this paper, gave an account of some further experiments upon the changes taking place in the low-temperature burning of Stourbridge fireclay. Some earlier work in the same direction was described before the Society in 1923, and certain conclusions were arrived at which depended chiefly upon the acceptance of a structure of the "clay substance" molecule similar to that postulated by Drs. W. and D. Asch in their exposition of the "hexite-pentite" theory. The present paper was an intended attempt to survey generally the application of the hexite-pentite formulæ to the burning of clays. Though accepting the hexite-pentite structural formulæ as a basis, the author does not agree with all Dr. Asch's views.

The first subject investigated was the coefficient of expansion of fired clay, in order to find a method whereby some definite physical property of the clay could be studied with reference to the effects of heat treatment. Houldsworth and Cobb have shown that the coefficient of expansion is affected by the degree of porosity of the specimen; but the author's experiments indicate that changes in molecular constitution have a much greater effect than those due to this cause. Indeed, it is stated that the effects observed are in complete accord with the probable changes in molecular structure as derived from its consideration in the light of the hexite-pentite theory. The results indicate that, in the case of material fired below polymerization temperature, quenching causes an enhanced chemical activity. It seemed probable, also, that some at least of the molecular transformations which occur during heating are reversible, providing cooling is sufficiently slow, and that such reversal takes place to a limited extent. Any attempt to investigate high-temperature molecular changes on cooled samples should, wherever possible, be supplemented by experimental methods capable of application during the actual process of the transformation, if the mechanism of that transformation is to be fully appreciated. An alternative explanation of these results might be founded on the assumption that some substance, probably silica, is thrown out of solution on slow cooling, while retained by quenching.

Dealing with the dehydration of clays on heating, the author's experiments agreed well with the hexite-pentite structural formulæ when the reaction is taken to completion.

COMPOSITION AND STRUCTURE OF FIREBRICKS.

One or two matters of interest to the gas industry emerged as the result of a paper by Mr. W. Emery on "Refractories for

the Pottery Industries," in which the author surveyed the requirements of the refractories used in the pottery industry. Normal fireclay firebricks were well within the standard as regards refractoriness, and resistance to thermal changes was also satisfied by the same materials. In a reference to the importance of the composition and structure of the bricks, and of their physical properties, he pointed out that the adjustment between the matrix and the grog should be such as to ensure equal rates of solution. Failures had occurred because this point had not been taken into account. Ball clay—China clay mixtures, unless great care were exercised, were particularly troublesome in this respect. Density was considered to be of great importance, porosity being taken as the criterion of this property. The type of pores, however, had a marked effect on the rate of solution; and good results were more likely to be obtained from bricks wherein the porosity was due to an infinite number of fine pores than where a small number of large and irregularly distributed spaces were present. A homogeneous structure would lead to a uniform rate of attack, compared (say) with marked resistance followed by abnormal erosion. There were certain types of refractories which glazed-over very quickly, with the formation of a glassy film on the surface; the latter offering great resistance to any further erosion or corrosion.

Discussion.

Mr. J. P. LEATHER said that in the gas industry firebricks failed in places where they were in contact with the fuel. If a furnace were properly designed and properly attended to, some portions of the brickwork would last for many years, but the part which was in contact with the fuel, and on which a quantity of ash was deposited, had to be renewed frequently. That seemed to be a matter which had not yet been fully investigated. On the question of chemical composition, he said that some American firms who used refractories in furnaces stipulated in their specifications for a material containing a large percentage of alumina; and he asked whether that type of material was to be recommended for use in the linings of generators of producers, &c., where the refractory had to withstand the effect of slag. In the generator of a water gas plant, for instance, there was a considerable amount of slag formed on the linings; and this slag had continually to be removed, and pulled portions of the firebrick with it, so that the latter did not last very long. Would it be advisable, in such a case, to use a material containing (say) over 40 p.ct. of alumina? As to porosity, the author's suggestion that good results were more likely to be obtained from bricks wherein the porosity was due to an infinite number of fine pores than where a smaller number of large and irregularly distributed spaces were present, was important. He was not sure, however, how that was to be determined. It was difficult to specify that a material should have a porosity made up entirely of very small pores, evenly distributed.

Mr. C. R. F. THRELFALL also referred to water gas producers, and said his experience was that the brickwork of a large number of producers was wrongly designed. He believed that in nearly all cases the arches were made of bricks, probably in two courses—an inner and an outer. There were six or seven bricks forming a 2-ft. arch, and there were 14 or 15 joints in the bottom of the arch, over the door. Very often the door was left open at night, so that there was a blast of air through. This had a deleterious effect upon the joints, and resulted in failure of the arch.

Mr. W. T. GARDNER urged the necessity for using an efficient jointing cement. Failure after failure had occurred in the gas industry due to the use of unsuitable jointing cement for cementing refractories which were otherwise perfectly satisfactory. If one used a jointing cement which was satisfactory from the fusion point of view, and put in a thick joint, there might be trouble in time. Recently, on the scrap heap in a works, he had seen some jointing cement which had been used for cementing together the bricks in a horizontal retort setting. Evidently, when the setting was built, the jointing cement consisted of straight fireclay, which was not altogether suitable, because when the clay was dried and heated-up, it shrank, and fissures appeared in the joints. If one had such a joint in the producer of a setting, for instance, fissures would appear, into which liquid slag would run, and very soon the joint would dissolve-out. If the joint dissolved-out, how could the bricks stand up to the high temperatures in a producer? He had been amazed to see people using ordinary fireclay in its straight form, instead of silica cement, for jointing silica bricks. At 1400° or 1500° C., the clay shrank, and actually dissolved into the silica bricks.

Dr. J. W. MELLOR, who, in the absence of the author, replied to the discussion, said that, though reports were contradictory as to the alumina content of refractories for use in furnaces, the genreal opinion was that the high-alumina brick was satisfactory. He himself would prefer 39 to 40 p.ct.

STORAGE OF SILICA REFRACTORIES.

Mr. W. J. Rees, in a paper on the storage of silica refractories, gave the results of some further experiments carried out in this connection since he delivered a paper on the subject to the Refractory Materials Section of the Society at the autumn meeting last year. This previous paper showed that silica bricks which had been stored without adequate protection from weather deteriorated considerably in mechanical strength. In the experiments made to ascertain the mechanism of this loss in strength, there were definite indications that bricks made from a well-graded batch, and well burned, would be more resistant to weather than bricks of lower quality. The experiments, therefore, were continued, to ascertain if this was actually so in the case of commercial silica bricks; and the results of these further experiments were given in the present paper.

Four different makes of commercial silica bricks were used. These were (*a*) fine-textured gas-works bricks; (*b*) fine-textured coke-oven bricks; (*c*) medium-textured steelworks bricks; and (*d*) coarse-textured steelworks bricks. Six bricks from each make, free from cracks or surface crizzles, were exposed in the following manner: (*a*) Immersed in cold distilled water for seven days, and slowly dried to constant weight in a warm room; (*b*) placed in the open, unprotected from the weather, from November to March (during which period there was occasional rain and frost, with a little snow), and slowly dried to constant weight; (*c*) placed in the centre of a shed with open sides from November to March, and slowly dried to constant weight; and (*d*) placed in the stock room from November to March.

The paper gave details of the chemical composition and physical properties of the fresh bricks, and the results of mechanical strength tests. It was evident from the experiments that highly-fired close-textured bricks were decidedly more resistant to deterioration from exposure to rain, frost, &c., than were bricks which had not been so thoroughly burned. None of the bricks showed any external evidence of deterioration. Bricks which had been exposed, and subsequently very rapidly dried in a current of hot air, showed a greater loss in mechanical strength than those which were slowly dried.

It could be concluded from the results of the experiments that, though high-quality silica bricks were more resistant to deterioration from exposure to weather, some deterioration would take place on prolonged exposure. It was obviously desirable to protect the bricks properly during storage, and, especially in the case of blocks, to take precautions to avoid wetting during transit.

Discussion.

Dr. J. W. MELLOR remarked that some clays had better weather-resisting properties than others, but no very definite conclusions had been drawn as to the reasons; it was not a question of porosity.

Mr. W. J. GARDNER said that, so far as silica was concerned, porosity had a lot to do with resistance to weather. He had noticed, as a manufacturer, that if silica bricks with a high porosity were subjected to atmospheric changes—particularly frost—there was a breaking-down, but it was not so noticeable when the porosity was very low.

Dr. MELLOR said he could imagine that the weathering of the matrix would take place more quickly with the more porous brick; but there was another action which must not be confused with this—namely, disintegration produced by the freezing of the water in the pores of the brick. In the case of flowerpots, there were clays with high porosity which stood quite as well as clays with low porosity.

Mr. REES suggested there was no absolutely straightforward connection between porosity and lack of stability during storage. It seemed likely that, with a higher temperature of burning, there was a better distribution of the bond through the brick, and, secondly, a bond was obtained which was more highly saturated with silica, and was less affected by moisture than the bond which was formed at lower temperatures. He did not say that porosity was not of major importance, but the more important point was the grading of the brick in order to secure uniform texture. He emphasized the importance of maintaining the maximum temperature of the ordinary-sized kiln for at least 24 hours during the burning operation.

ELECTION OF OFFICERS.

A general meeting of the Section was held on Wednesday afternoon, the principal business being the election of officers.

Mr. Frank West remains in office as President of the Ceramic Society.

There are three Vice-Presidents of the Refractory Materials Section. Mr. H. J. C. Johnston (Leeds Fireclay Company) was elected to fill the vacancy caused by the retirement of Mr. A. Cliff (Williamson, Cliff, Ltd.). The two Vice-Presidents who remain in office are Mr. H. G. Colman (Consultant, London) and Mr. F. H. Brooke (Oughtibridge Silica Brick Company).

An invitation to hold the Spring meeting of the Section in Cornwall next year has been accepted.

ANNUAL DINNER.

The annual dinner of the Section was held at the Holborn Restaurant on Wednesday, Sept. 16—the President (Mr. Frank West) being in the chair.

After the toast of "The King,"

Prof. H. E. ARMSTRONG proposed "The Ceramic Society." He remarked that the Society was formed 25 years ago with the object of infusing into the people of Stoke-on-Trent and the Potteries district some scientific knowledge of the pottery industry. In recent years the pottery industry had adopted a new kiln fired by gas, which had to be worked on entirely different lines from those of the old types of pottery kilns; and he believed it had been realized that the men who had succeeded in the use of these gas-fired kilns really knew their work, and had succeeded because they were prepared to deal with a new condition of things.

The PRESIDENT, replying to the toast, said that, thanks to the work of the Refractory Materials Section, the users and manufacturers of refractory materials had been brought together, with the result that the user had discovered that the making of refractory materials was not such a simple problem as he once imagined. At the same time, the manufacturer, by research and investigation, had been able to improve his materials, and make a better article to suit the user. The Ceramic Society helped the members to study their problems, and improve their works. There was considerable waste going on on the floors of their works, and through over-burning and under-

burning of the bricks; and it behoved the manufacturers to take full advantage of the information made available by the work of the scientists, in order that these losses might be reduced. Therefore, he urged the members and the industry as a whole to support the Society and promote its welfare.

Dr. H. G. COLMAN, proposing "Kindred Societies," said the kindred scientific and engineering societies could be likened to a multi-cylinder engine which could not be expected to function unless all the individual cylinders were performing their proper work. While not suggesting that there was very much wrong with the scientific societies, there was a feeling among some people that more could be done. It might be that the efficiency of some of the cylinders was not all that it might be, and that some of them might even be scrapped and replaced by one large one. There was a tendency for some of the cylinders to work one against the other rather than all together; and this necessarily had the effect of reducing the total B.H.P. in relation to the I.H.P. of the individual cylinders. In short, he suggested that there was room for great improvement in the co-ordinated work of the various scientific societies.

Dr. W. R. ORMANDY responded, and pleaded for a little more humour and light-heartedness at scientific meetings, as a means of creating greater interest in scientific problems.

Mr. W. GARDNER proposed the toast of "The Visitors."

The Rt. Hon. the LORD MAYOR OF MANCHESTER (Alderman F. J. West) said he was pleased to reply to the toast—first, because his brother had been honoured by being elected President of the Ceramic Society, and, secondly, because he himself happened to be connected with that section of engineering which derived great benefit from the work of the Society, and he realized that not a little of the success of that particular branch of engineering depended upon the efforts of the members of the Ceramic Society. After pleading for a greater appreciation of the value of research work, Alderman West called attention to the manner in which other countries regarded scientific education and research, by pointing out that during a recent visit to Stockholm he saw there one of the finest colleges of technology in the world, in which they had specialized in no fewer than five branches of engineering—and that in a country with a population of something like 6 or 7 millions. These branches of engineering were mechanical, electrical, mining, civil, and chemical.

The final toast was that of Dr. J. W. Mellor, the Hon. Secretary of the Society, who was warmly thanked for the work he is doing on its behalf.

Thursday, Sept. 17.

A NOTE ON SOME CASES OF "SPALLING" IN SILICA GAS RETORTS.

In this paper, Mr. W. J. Rees (Sheffield University) said that two cases of "spalling" (in silica gas retorts) which presented unusual features had been brought to notice during the last few months. In both cases the spalling occurred during the removal of scurf from the retort. Normally, scurf is easily removed from silica material, as there is little or no penetration or deposition of carbon; but, in these two examples, several small patches of carbon were visible on the internal face of the spalled pieces, and faint cracks could be seen round these small black patches. The spalled pieces of retort were $\frac{3}{8}$ to $\frac{1}{2}$ in. in thickness, and the black patches were $\frac{1}{4}$ to $\frac{3}{8}$ in. in diameter. The latter were internally deposited scurf, which was continuous with the normal scurf, and acted as an anchor for the scurf, and prevented its ready removal from the wall of the retort. In order to ascertain if any local differences in composition were associated with the localized internal deposition of carbon, some of the black patches were carefully cut-out for analysis, and a portion of the clean material was analyzed for comparison. The following results were obtained:

—	Clean Material.	Black Patches.
	P.Ct.	P.Ct.
Silica	94·86	74·50
Lime	2·06	1·45
Alumina	1·03	1·13
Iron oxide	0·92	5·18
Carbon	*Nil*	12·50

Apart from the carbon content, the essential difference in the two analyses is in the content of iron oxide; and a segregation of iron oxide in the black patches is indicated.

It is well known that, at red-heat temperatures, iron oxides facilitate the decomposition of carbon monoxide, with deposition of carbon, and it seems to be a reasonable deduction that small segregations of iron oxide in the silica retort material have resulted in the deposition of carbon round the segregation as a nucleus. This, besides causing local adhesion of scurf, would conceivably lead to a weakening of the silica material round the deposited carbon, and a gradual development of cracks.

In order to test this suggestion, some pieces of silica brick were taken, and small segregations of iron oxide made in them by localized impregnation with solutions of ferrous sulphate followed by gentle heating in a current of air. These treated pieces of brick were then heated to about 800° C. in a current of carbon monoxide. When the addition of ferrous sulphate was such as to give a localized concentration in the brick of up to 2 p.ct. of iron oxide, there was no deposition of carbon inside the brick after some hours' heating in carbon monoxide, but there was a slight blackening of the skin of the brick on the iron oxide spot. With a localized iron oxide concentration of above 4 p.ct., deposition of carbon inside the skin of the brick was observed after six hours' heating in carbon monoxide. Analysis of some of these "carbonized" iron oxide spots gave approximately 4 p.ct. of carbon. It is, therefore, evident that the presence of segregated iron oxide in silica material may, when the material is heated in the presence of carbon monoxide, lead to the internal deposition of carbon when the concentration of iron oxide is sufficiently high.

The examination of the spalled material and the laboratory experiments suggest the desirability of using every care to avoid segregations of iron oxide in silica material which is to be used in gas retorts. The observations and experiments are possibly insufficient to be regarded as conclusive, but they provide a probable explanation of the cases of spalling cited, as it was contended that it was most unlikely to be due to sudden chilling of the retort. It may, however, be pointed out that, if planes of weakness were caused by this internal carbon deposition, a chill insufficient to affect normal retort material might cause spalling.

Discussion.

The PRESIDENT expressed the thanks of the Section to Mr. Rees for giving some information on a matter of considerable interest.

Dr. J. W. MELLOR asked how the iron became segregated.

Mr. REES said it was probably from the pan mill during the grinding of the raw material.

Dr. MELLOR remarked that this was an interesting point, because some curious movements of the iron in fireclay materials were often noticeable. For instance, there were often what appeared to have been miniature volcanoes inside firebrick or even silica brick, judging from the spots which showed up on the surface. Tracing these down, it seemed that there must have been some iron compound formed below. Possibly—although he was not certain—sulphuric acid had formed sulphate of iron, and had produced what might be termed little volcanoes. The segregation might be due to other causes than those thought of by Mr. Rees.

Mr. H. M. RIDGE said that in the gas retort there was a considerable volume of hydrocarbons; and if the silica material about which Mr. Rees had written was in contact with these hydrocarbons at certain stages of the distillation, there was always the possibility of hydrocarbons in the gaseous form penetrating and filling up the voids due to the porosity of the bricks. These hydrocarbons were then decomposed, and there was a deposition of carbon. Possibly Mr. Rees could say something about the porosity of the brick with which he experimented. After the carbon had been deposited, there seemed to him to be another explanation regarding the introduction of the iron. In the presence of hydrocarbons, what was the action and what was the condition of the carbonyls of iron? Speaking from memory, he believed that the literature on the subject told them only of two of these carbonyls; but he believed there were three. There was one which was particularly interesting at about 900° C. and slightly above. Was it not possible that this carbonyl might be decomposed in contact with the brick material and the carbon which was present in the pores of the brick, and be deposited there as iron? There was another material or compound present which was peculiarly active in the presence of reduced iron. In the gas retort there were H_2S and analogous compounds, and also SO_2. Possibly these were reduced, and formed a sulphide of iron.

Mr. GARDNER said there was an explanation of the increased iron content of a silica brick; it was probably due to the penetration of ferrous chloride which was formed in the retort as the result of decomposition of sodium chloride. He had seen instances in which the iron content had been increased considerably in that way. The iron seemed to migrate from the inside of the retort right to the combustion side. The introduction of carbon was easily explained by the penetration of hydrocarbon gases, and, to a certain extent, by diffusion; the gases in the retort being lighter than the gases in the combustion chamber. There was a tendency for this diffusion to go on through the material; and if there were volatile iron compounds, or alkali compounds, these would diffuse with the gas on the retort side, and carry with them, to the combustion chamber side, the iron which was deposited on the inner surface of the retort. It was remarkable to examine silica bricks that had been in use for a good many years, and observe the colour bands throughout a brick 4½ in. thick. The colours ranged from brown on the retort side, through green, to the normal colour of the brick on the combustion chamber side. This pointed to some passage of the iron from one side to the other, through liquefaction.

Mr. REES, replying to the discussion, said that the migration of iron chloride referred to by Mr. Gardner could be seen in the coke oven, where semi-silica or fireclay bricks were used. In some cases there was an actual deposition of hematite in the zone of the brickwork somewhere near the flue, where the oxygen had penetrated. This deposition was one of the most important causes of weakness in bricks in coke ovens. For some reason, this did not take place nearly so rapidly with silica bricks, which fact was an important argument for the use of silica bricks in coke ovens and gas retorts.

Mr. H. GAGE (Sutton Gas Company) remarked that a few years ago he put in some silica retorts in his works. So far they had retained their shape beautifully, and gave every indication of having a long life.

PRESIDENTIAL ADDRESS OF MR. FRANK WEST.

My special theme to-day is the value of research. I particularly mention this because the British Refractories Association, of which the Ceramic Society was one of the principal sponsors, has just completed its first five years of existence. It has recently been in negotiation with the Government for a grant over a further limited period which will enable it to establish itself as a self-supporting organization. This Research Association has now got into its stride, and the work it has done has received high praise from the independent scientific experts

who lately reviewed its operations. The Association is doing important work for the industry. Much of this has necessarily been "spade work," and the full advantage will only be gained if the Association is able to continue its activities. The Association deserves and needs the best possible support from the manufacturers and users of refractories; and unless satisfactory support is forthcoming, the Government grant will be discontinued. So I appeal very strongly to all of those who make or use refractories, and particularly to the members of this section of the Ceramic Society, to do their utmost to support the Research Association.

Even in these enlightened days there are some people who look with suspicion upon research, who regard it as a charity, or perhaps a hobby, rather than as an essential adjunct to competitive industry of the present day, and who are difficult to convince of the benefits accruing therefrom. In one important respect the manufacture of refractories differs very markedly from many other industries. We have no uniform raw material. Our products are not standardized by composition, but are judged by their performance. The individual manufacturer must take the particular clay at his disposal, and, by modifying his processes, make the best of it. For this reason wide scientific knowledge is essential to progress, and research is perhaps more necessary than in an industry which uses raw materials of standard composition and properties. But this is not the only reason for research in the refractories industry. Industrial developments of the future will inevitably call for improved performance of refractories. Already we hear of the construction of boilers to operate at greatly increased pressures. Cheap oxygen may appear at any time to be utilized in metallurgical operations. In either case refractories of exceptional properties will be required; and only by research can we put ourselves in a position to meet the coming demands.

Many examples may be given showing the usefulness of research. Mr. Barnard Moore spoke fully on this matter on the occasion of the coming-of-age of the Ceramic Society, and gave some particular instances which proved the great advantage which had been obtained in the pottery industry by research. I now propose to touch briefly on the gas industry, in which I personally have had a large experience. The gas industry could not have made such rapid strides but for the improved refractory materials, due chiefly to the special investigations and research by the Ceramic Society and kindred bodies. The method of the carbonization of coal in gas-works has been greatly improved in recent years. A few years ago the gas engineer was satisfied if he obtained 1000 days' life out of his retorts at moderate heats; but now the heats are considerably increased, giving better results with larger makes. This is due to the progress made by the manufacturer. Refractories have been produced which not only withstand these increased heats, but give longer life than formerly at the comparatively low heats then in vogue. At one time there were many instances when the retorts were obtained in the cheapest market, irrespective of quality and the duty they had to perform; but I venture to say that the user now requires something for his money, and, moreover, is able to obtain it in this country. These results have been brought about gradually, due to research which the manufacturers and users, with the aid of scientists, have carried out, and also to a better understanding of the condition and general uses to which the material is put. I maintain that during this period of improvement the status of the manufacturer of refractories has very materially increased, and the user, while probing into the difficulties that arise, has begun to realize that refractories require intelligence in their making-up, and that there is some brain, besides brawn, employed in making refractory goods.

There is the important matter of erosion of refractory materials both in gas and coke-oven works. Though not yet cleared up, it is becoming by research and a process of elimination more understood; and if such important investigations are allowed to continue, the problem must in the end be solved, or at least alleviated. I venture to say that such research will go a long way towards assisting the home country to combat foreign competition. Before the war many of these countries were spending large sums of money on research (sums which they are spending still), much more than we have contemplated or are contemplating. If we are to keep our business going, we must do the same.

This Society is a centre for scientific and technical thought in the ceramic and refractories industries. Through it the results of research are exchanged and discussed in all their bearings. The value of the work of the Society is greatly enhanced by the visits to works in this country and abroad which it arranges. Members thus keep in touch not only with scientific advances, but also with actual technical practice; and the Society is an instrument in the progress of the industries. At one time there was a great prejudice among manufacturers against visiting competitive works and meeting together, as was pointed out very fully by Mr. Montgomery at the clay convention at Buxton; but this has now, I believe, almost disappeared. I wish to point out that the great advantage of these visits is that sometimes we see a particular process carried out differently from our own, but which obtains the same final result. In addition, this meeting of fellow managers, and discussions over difficulties and methods not generally reported in the Press, in the end increases the knowledge of the individual, and is of immense advantage to the industry as a whole.

Though we have some interesting papers before us at our meetings, I feel that we have not enough of the practical physic, but that we are rather inclined to err on the theoretical side. One would wish to have more papers on the practical results of the various phases in manufacture, and combine them with the theoretical. I feel sure, if this were done, it would bring a much larger attendance of the business men to our meetings. I therefore appeal to all those engaged on the practical side of our business to endeavour to contribute as much as possible in the future by paper or discussion, so as to balance our subjects.

No doubt many of you have read the communication from Mr. H. J. C. Johnston, of Leeds, which appeared in the July number of "The Clayworker," regarding the clay convention at Buxton. Though he does not particularly refer to the Ceramic Society, there are some valuable hints which may be applied to our Society, and which are well worth our consideration. He specially refers to the business side of the industry, and suggests that there should be a more frequent exchange of views at our meetings on this subject.

In conclusion, may I say that while we have these regular meetings of the Society, and discuss the many details in an open and friendly spirit, and at the same time have the guiding hand of our friend and Honorary Secretary, Dr. Mellor, we need have no fears for the future progress of our Society.

Benzole Poisoning.—It is stated by "Industrial and Engineering Chemistry" that progress reports in the United States on this subject, issued by the Sub-Committee on Benzole of the Committee on Industrial Poisons, National Safety Council, emphasize the importance of the work. Investigations disclosed the fact that 15 deaths and 83 more or less serious illnesses have occurred as a result of industrial benzole poisoning during the last few years. It was reported that out of a group of 84 workers exposed more or less continuously to benzole fumes in varying concentration, 13, or 15 p.ct., showed a white blood cell count so low as to be strikingly suggestive of chronic benzole poisoning.

Industrial Gas Appliance Research.—The suggestion has been made by Mr. Charles A. Monroe, Chairman of the Laclede Gas Light Company of St. Louis, that the gas industry of the United States should create a fund of $1,000,000 to finance the development of industrial gas-consuming appliances. His idea is that the money should be contributed by the gas companies who are members of the American Gas Association, on a five-year basis, which would amount to 5½c. yearly on each $100 of gross revenue for each company. Admitting that the application of gas to the heating problems of industry calls for continuous research on an extensive scale in the development and improvement of appliances, Mr. Monroe thinks this is work which the companies can do better collectively than they can individually.

Problem of Boiler Scale.—Actinum Developments, Ltd., of Alder House, Aldersgate, E.C. 1, claim to have found a solution to that bugbear of power house engineers—boiler scale. In the feed tank of the boiler, one or more "Etherium" activated cylinders are suspended. These precipitate the scale-forming solids as fine powder, which can be blown-off, or, on occasional opening, can readily be removed by washing or brushing down. At the same time, state the firm in a booklet which they have recently published, "Etherium" breaks away all the old scale in any part of the pipes and boiler. The activators are filled with a non-chemical medium, and are made in several sizes according to the quantity of water to be treated. Actinum Developments, Ltd., who control the process, do not sell the activators, but rent them to actual users.

New Mains, &c., for Nantwich.—The Nantwich Gas Committee have decided to make application to the Minister of Health for a loan of £2000 for the provision of new mains, services, cookers, meters, &c.

Morecambe Gas Undertaking.—At a meeting of the Morecambe Town Council on Sept. 22, Mr. J. C. Wilson (Chairman of the Gas Committee) reported progress in the reconstruction of the works. The fall in the price of residuals was a factor in the net loss of £4426, another factor being £1500 for new mains. The income was £46,171, and the expenditure £36,787, leaving a gross profit of £9394, but interest on loans, income-tax, &c., took £13,830. Through shortage of capital they had to pay £789 in bank interest. The new carbonizing plant was giving good results.

Keighley Gas Centenary.—On Oct. 19, the Mayoress of Keighley (Mrs. R. Calverley) will open an exhibition of gas appliances, and a museum showing the development of the gas industry during the past hundred years, to be held from Oct. 19 to 24 at the Municipal Hall, to celebrate the centenary of the manufacture and use of gas at Keighley. The construction of the Keighley Gas-Works was authorized in 1824, and the opening was in October, 1825. Gas in the early days of the undertaking was supplied at 10s. per 1000 c.ft., and the works closed each year from the middle of May to the middle of September. After two years the price was increased to 11s. per 1000 c.ft. In 1840, when the undertaking had got well on to its feet, the consumption was 4 million c.ft. To-day it is 445 millions.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Industrial Gas Prices.

SIR,—May I mention a point with a view to clearing misconception? A contemporary's report of Dr. Smith's lecture states that in the matter of differential rates this country is limited by legislation to not more than 15 p.ct. reduction—referring apparently to the Model Clause (No. 21 in the 1923 revision).

By such, the discounts or rebates allowable in consideration of prompt payment are not to exceed in any case 10 p.ct., and in addition thereto or irrespective thereof the discounts or rebates to large consumers are not to exceed in any case 15 p.ct.

Thus, subject to prompt payment, the limit of allowance to large consumers would be 25 p.ct., not 15 p.ct.

OIKONOMIA.

Sept. 28, 1925.

Tar v. Bitumen.

SIR,—It had not been my intention, before reading "Safety First's" letter in your issue of to-day, to enter any further into discussion on this subject, since all that it amounted to was the waging of a battle of words with a gentleman whose idea of the proper conduct of a controversy appears to be that it consists in indulging in cheap witticisms at one's opponent's expense, and imputing interested motives where none exists, without attempting to deal seriously with the main points at issue. Such persons, whose ideas of argument are pretty much on a par with those of a Communist agitator, are best ignored.

"Safety First's" letter is, so to say, a horse of another colour altogether. I note his criticisms of some of my remarks with interest; but I do not think that he has quite grasped my attitude. My point is that it has not yet been definitely shown that bitumen is really inferior to tar as a surfacing medium. It is true that the gas companies and the tar distillers *say* that it is; but since they are the people that are adversely affected by the use of bitumen, I cannot admit that their statements are acceptable as evidence. A single party cannot equitably be judge and advocate in one case. It is particularly so in this instance; for I used to be actively connected with the gas industry, and have some inside knowledge of its ways.

I quite agree that some bitumen-made roads are horribly slippery in wet weather—a stretch near Eton Socon comes vividly to mind. But, on the other hand, this dangerous quality need not be inseparable from a bitumen road. Near to my present residence is a ten-mile section of main road which has recently been resurfaced with bitumen and granite chippings. I have frequent occasion to drive a car over this road, and I can honestly say that I have never found any undue tendency to skidding, even in the wettest weather. It seems really that the treacherous nature of certain bitumenized surfaces is due, not to the bitumen itself, but to using the solid and plastic constituents in incorrect proportions. This is a thing that very often happens—whether through lack of knowledge on the part of the surveyor or through inefficient supervision of the workmen, I will not venture to say. Thus about two years ago a piece of road half-a-mile in length and about a mile from my house was remade, using dehydrated tar. The solid constituents were used in insufficient quantity; and as a result it has ever since been possible (wherever any of the surface is left at all!) to go to this piece of road on a hot summer's day, and push the heel of one's shoe down a quarter of an inch in the road, the top of which has, under the heat of the sun, assumed the consistency of thick glue. Comment is needless.

With all that "Safety First" has to say about the nuisance from tar-splashing I am in complete agreement, having been on many occasions a fellow-sufferer. It would be well if it were made an indictable offence for a local authority to permit road repairs to be done in such a way as to lead to damage of the coachwork of cars using the roads. As regards horse traffic, I do not altogether agree with him. There is not the slightest doubt that horse-drawn vehicles are doomed sooner or later to disappear from the roads; and I do not see that it is to the interests of motor transport to make sacrifices for the sake of a form of road traffic that is responsible for more congestion than any other, save only the electric tramway. In any case, where the road is sufficiently wide, it would be a simple matter to leave a strip at one or both sides surfaced only with waterbound macadam for the use of horse-drawn vehicles. I do not think that the use of tar instead of bitumen would much improve the horses' lot, judging from the complaints I have heard from users of horses relative to the slipperiness of roads on which nothing but tar has been used.

I trust that "Safety First" will accept these comments in the friendly spirit in which they are made. In any case, I feel quite sure that, unlike my previous opponent, he will not attribute to me any other motive than the desire to get the very best type of surface possible.

MOTORIST.

Sept. 24, 1925.

[The question is tar *v.* bitumen, and not mud. We hope correspondence on the subject will be kept free of personalities.—ED. "G.J."]

The Morecambe Corporation Gas Department had an attractive exhibit in the street trades procession in connection with the seventh annual Morecambe autumn carnival and shopping week. Their wagon was arranged to represent various all-gas rooms, containing fires, cookers, boilers, &c., together with a display of gas fittings suitable for office use.

REGISTER OF PATENTS.

Gas Fire Guards.—No. 238,673.

RADIATION, LTD., of Birmingham, and YATES, H. J., of London.

No. 17,069; July 16, 1924.

The object of this invention is to enable excessive heating of an adjacent carpet to be avoided in a simple and effective manner without materially impairing the efficiency of the fire. The invention comprises the employment of fixed horizontal reflecting strips which in cross-section are upwardly inclined, to deflect the heat radiating from the hottest part of the fire, and thereby reduce the normal heating effect at a position close to the fire; the strips being attached to the front of the fire.

Geysers.—No. 238,678.

BARRALET, J. H., and NEW GEYSERS, LTD., both of London.

No. 17,721; July 24, 1924. No. 27,113; Nov. 13, 1924.

This invention has for its object to provide improved means for supporting the main body and to facilitate access to the interior of the lower or base portion of a geyser and the burners contained therein for cleaning purposes. The main body of the geyser is supported at a suitable distance above the base-plate by means independent of the separate slotted lower portion or fret which surrounds the burner. Such support means preferably consist of a fixed ring or condensation channel, and uprights or pillars securing this ring to the base-plate. Access to the burner is facilitated either by arranging the slotted lower portion of the geyser body so as to be capable of sliding up and down upon the main body; or, alternatively, the separate slotted portion, instead of sliding, may be provided with a door opening having a hinged door connected with a swing burner capable of being swung out of the casing. The base-plate consists of a solid smooth plate which can be easily cleared of deposit.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Sept. 16.]

Nos. 22,262-22,843.

BARNES, F. V.—"Control of gas lighting systems." No. 22,669.
BERNARD, E. L.—"Gas fire-lighters." No. 22,270.
BROWN, J. H.—"Regenerative coke ovens." No. 22,370.
EVERED & Co., LTD.—See Barnes, F. V. No. 22,699.
HOWARD, T.—"Appliance for saving gas and coal." No. 22,475.
MARTIN, C. H.—"Manufacture of gas mantles." No. 22,608.
PLASSMANN, J.—"Distillation or coking of fuels." No. 22,772.
SIMON-CARVES, LTD.—See Brown, J. H. No. 22,370.
TERRELL, T.—See Martin, C. H. No. 22,608.
WINTERFLOOD, B. W.—"Geysers, &c." No. 22,526.

[Extracted from the "Official Journal" for Sept. 23.]

Nos. 22,844-23,448.

CASSEY, E.—"Oven for gas cookers." No. 22,981.
CASSEY, H.—See Cassey, E. No. 22,981.
COOKE, A. G.—"Stuffing-boxes for gas meters, &c." No. 23,349.
DANIELLS, J.—"Ovens for distilling coal, &c." No. 22,899.
GLOVER, J. A. F.—"Gas fires." No. 23,090.
HEDWORTH, W. A.—"Liquid-fuel and gas burners." No. 23,168.
HUNTER, C. M.—"Atmospheric gas and oil burners." No. 23,346.
KELLNER & FLOTHMANN GES.—"Apparatus for regulating gas and air for furnaces." No. 23,328.
PHILLIPS, B. C.—See Cooke, A. G. No. 23,349.
PHILLIPS, R. A.—See Cooke, A. G. No. 23,349.
RITCHIE, HART, & Co., LTD.—"Mixing device for air and gas." No. 22,854.
SINGLETON, H.—"Apparatus for handling and discharging coke, ashes, &c." No. 23,040.

Gas Poisoning at Belfast.—On Monday, Sept. 14, Mrs. Fricher, Robert Sands, and his wife were discovered dead in Hopefield House, Belfast. The three retired to bed in the same room on Saturday night; and it assumed that the gas was left with a small light, which was later blown out, so that the gas escaped, and, gradually filling the room, poisoned the occupants. Inspection by Corporation officials proved that there was no defect whatever in the fittings or the meter.

Extensions of Plant at Foleshill Gas-Works.—The Coventry City Gas Committee have recommended that application be made for sanction to a loan of £230,000 for extensions of plant at the Foleshill Gas-Works; this being instead of the recommendation adopted by the Council on March 31 last, but which it is now proposed shall not be proceeded with, to make application to the Board of Trade for a Special Order under the Gas Regulation Act, to authorize the borrowing of £350,000 for various extensions of plant, and for other purposes.

Edinburgh Gas Meter Testing Department.—In his report for the year ended May 16, Mr. W. Gordon, the Official Inspector, states that the number of meters tested and examined amounted to 76,733—1978 wet meters and 74,755 dry meters; and fees to the amount of £2243 were collected. The total number of meters tested and examined by the Department since its institution in 1861, up to and including May 15, amounts to 3,510,586—the fees received for the same period being £110,702. During the year all standard test holders—seven 10-c.ft. and nineteen 5-c.ft.—were completely overhauled in preparation for the decennial re-verification, which is due at an early date.

MISCELLANEOUS NEWS.

GAS REGULATION ACT APPLICATIONS.

The following notices have appeared in the "London Gazette" regarding applications to the Board of Trade under the Act.

SPECIAL ORDER.

Knottingley Gas Company.

The Company intend to apply for a Special Order under section 10 of the Act, to authorize the Company to consolidate their existing capital, and for other purposes.

AMENDING ORDERS.

North Middlesex Gas Company.

The Board of Trade give notice that the Middlesex County Council have made application under sub-section (3) of section 1 of the Act for an Amending Order revising the powers of charging authorized by the North Middlesex Gas (Charges) Order, 1921, by reducing the standard price prescribed by that Order.

Pinner Gas Company, Ltd.

The Board of Trade give notice that the Middlesex County Council have made application under sub-section (3) of section 1 of the Act for an Amending Order revising the powers of charging authorized by the Pinner Gas (Charges) Order, 1921, whereby it is desired that a standard price of 16·2d. per therm be prescribed.

DECLARATION OF CALORIFIC VALUE.

Torquay and Paignton Gas Company.—480 B.Th.U. throughout the area. (Jan. 1, 1926.)

BRITISH GAS LIGHT COMPANY, LTD.

At the Annual Meeting to-day (Wednesday) the Directors will submit their report (signed by Mr. Henry Woodall, the Chairman and Managing Director) and the statement of accounts for the year ended June 30.

They regret to announce the resignation of Mr. Frederick Wilkin, after the completion of 50 years' service on the Board, and feel sure that the stockholders will join with them in the wish that he may long enjoy good health. They have appointed Mr. Graham Wilkin to fill the vacancy.

The results of the year's working are that, after providing for interest on debentures and debenture stock, the net revenue amounted to £51,919, which, with the undivided balance brought forward from the preceding year, left an available balance of £98,849. From this sum the Directors have paid the dividend at the rate of 7 p.ct. per annum on the cumulative preference stock and an interim dividend at the rate of 3½ p.ct. on the ordinary stock. They now recommend that the payment of the above dividends be confirmed, and that a final dividend on the ordinary stock at the rate of 4 p.ct., less income-tax, making 7½ p.ct. for the year, all less income-tax, be paid on Oct. 9. This will amount to £26,932, and leave a balance of £41,725 to be carried forward.

The quantity of gas sold was 5½ p.ct. more than in the year to June, 1924.

At an extraordinary general meeting held on Feb. 18, 1925, the stockholders approved an application to the Board of Trade for a Special Order under section 10 of the Regulation Act, 1920, to empower the Company to expend additional capital at Trowbridge and to use further lands for the construction of gas-works. The Order has now been made by the Board of Trade, and was approved by Parliament on June 17, 1925.

The Company have recently purchased the gas undertaking at Wymondham, in Norfolk, and the Directors propose to apply to the Board of Trade for sanction to incorporate it with the Company's Norwich Station.

Practically the whole of the stock of the Bradford-on-Avon Gas Company has also been purchased by the Company; and this undertaking is now controlled by the Directors. At a later date it will probably be expedient to apply for parliamentary sanction to combine it with the Company's Trowbridge undertaking.

The Directors who retire are Mr. L. R. Abbey-Williams and Mr. Graham Wilkin; and the Auditors are Mr. E. Knowles Corrie and Mr. William Cash, F.C.A. They offer themselves for re-election.

Belfast Gas Exhibition.—The exhibition has been a signal success. Over 66,000 people in all patronized it during its fortnight's run. The cookery demonstrations were attended by 6500 people, and every lecture given had a crowded attendance. So great was the appreciation manifested of the various appliances for lighting and heating shown, that nearly 1200 orders were taken, and several thousand more inquiries will doubtless lead to further business.

Fairy Gas Competition Awards.—The Lord Mayor (Alderman P. Bower) presided at a prize distribution at the Municipal Technical School, Birmingham, on Sept. 23, when the Lady Mayoress presented the awards to local students who had been successful in the tenth annual Fairy Gas Competition organized by the British Commercial Gas Association. In addition to the usual prizes, this year a £50 scholarship was offered for the best essay on the subject of "The Gas Meter and Household Economy." The Birmingham Gas Committee agreed that, should a Birmingham student win this scholarship, they would add £25 to its value. Ethel Wood, of No. 19, Hampton Road, Stockland Green, a pupil at Slade Road Council School, was successful in winning the first prize, and therefore becomes entitled to £75 as a scholarship.

NEW SHOWROOMS AT RAMSGATE.

The Ramsgate Corporation Gas and Water Department have opened a new office and showrooms in the heart of the town, at the junction of Turner Street and High Street, in order that the public may be made fully aware of the possibilities of gas as an illuminant and for heating and cooking purposes. This is a step upon which Mr. R. H. Ruthven (the Engineer and Manager) is to be congratulated. The old Gas and Water Offices in Boundary Road, erected in the time of Mr. W. A. Valon as Engineer to the Corporation undertakings, will still carry on their useful purpose; but the new showrooms will introduce all the most up-to-date appliances for use in any kind of home.

On the ground floor there is a fine room to display the exhibits of the Gas Department. The place is panelled in Tudor oak brown, with a restful cream colour to the ceiling and a floor of oak parquet. Artificial illumination is controlled by means of distant-lighting pneumatic switches; and there are effective silk shades to the lights. Below the main showroom there has been dug out of the chalk a high-pitched basement, where the Department may give practical demonstrations. In this basement there have been fitted "Bon Marché" semi-indirect lamps.

On the first floor there is a space fitted up as a kitchen, and stoves of the most modern type and two "Ramsgate" geysers—one suitable for baths and the other for plate-washing purposes. There is, on the same level, a comfortable dining-room, made beautiful by panelling which, although it resembles oak, is really fashioned of cement. On the second floor is a room fitted with a bedroom suite and appropriate lighting and heating apparatus, including a device which may be used either for gas or coal consumption, being quickly converted. The second floor includes a small room to be used as an office.

Everywhere opportunity has been taken to demonstrate the uses to which gas may be economically put, as well as how stoves and means of illumination can be made to harmonize with any scheme of decoration or any class of room.

VERTICAL RETORT INSTALLATION FOR ABERTILLERY.

Inquiry into the Application for a Loan.

A Ministry of Health Inquiry was conducted at the Council Chambers, Abertillery, on Tuesday, Sept. 22, by Mr. R. H. Hooper, O.B.E., M.Inst.C.E. (Inspector from the Ministry of Health), into an application of the Abertillery Urban District Council to borrow £13,500 for the installation of vertical retorts, a 20-ton weighbridge, and for extension to mains.

The Clerk to the Council (Mr. W. Gait) said the Council had been discussing the question of vertical retorts for many years. Twelve months ago the Engineer was instructed to make further inquiries, and as a result the Gas Committee submitted a scheme to the Ministry for approval.

Mr. Ifor G. Jenkins, the Gas Engineer and Manager, detailed the advantages claimed for vertical retorts, and calculated a gross saving of £1900 per annum, after paying interest and repayment charges. He stated that the number of consumers was 605 ordinary and 4405 prepayment. The gas made during the past year was 87,397,000 c.ft., as compared with 92,126,000 c.ft. during the previous year. The outstanding debt on the undertaking at March 31 last amounted to £20,149—equivalent to £300 per million c.ft. of gas sold. The net profit for the past year was £416, making the total balance standing to the credit of the net revenue account £3441.

The Inspector questioned the Engineer very closely in regard to the suitability of Monmouthshire coal for vertical retorts, and stated the whole position would rest on this matter. He suggested that a careful investigation should be made before embarking on the scheme.

After closing the inquiry, the Inspector visited the gas-works.

UNION MEN AND NON-UNIONISTS.

Trouble arose last week among gas workers in the Manchester area over the old question of unionists working with non-unionists; a union branch meeting unanimously passing a resolution in favour of immediate "down-tools" action unless non-unionists came into line with organized workers.

Mr. Jack Williams, Organizer of the Gas-Workers' Section of the National Union of General and Municipal Employees, stated to a "Manchester Guardian" representative that the situation was serious. "The men," he said, "are tired of working alongside others who decline to become members of a trade union; and it is only with the greatest difficulty that they have been persuaded against taking action on their own. I have undertaken to bring the whole question of non-union labour before the Regional Council, and also before my own national executive. There are not more than 10 to 15 p.ct. of gas workers outside the trade unions. Key men are organized to 99 p.ct., and the problem mainly concerns general labourers. Between 9000 and 10,000 men in this area have declared for a strike unless all employees become identified with the trade union movement. The question of non-union labour has been discussed with the employers on many occasions. Several authorities have so far agreed with us that they have posted notices up in the works advising that, while they are not prepared to force men into unions, in their opinion the workpeople's interests were best served through agreements with recognized trade unions."

The price of gas at Camborne, Cornwall, will be reduced by 3d. per 1000 c.ft. from the end of this month.

INSTITUTION EXAMINATIONS IN GAS ENGINEERING AND GAS SUPPLY, 1925.

SUPPLEMENTARY LIST OF SUCCESSFUL CANDIDATES.

When publishing in the "JOURNAL" for Aug. 19 (p. 452) results of the recent examinations in Gas Engineering and Gas Supply held under the Education Scheme of the Institution of Gas Engineers, it was stated that, as several candidates had not fulfilled the whole of the requirements of the scheme, a short supplementary list might be necessary. This we have now received from Mr. Walter Hole, the Organizing Secretary.

GAS ENGINEERING—ORDINARY GRADE.

Birmingham Technical School.

Name.	Class.	Ancillary Subjects Taken.
Brettle, O. S.	2nd	Maths., Chemistry, Physics, Engineering, Drawing, Mechanics.

Huddersfield Technical College.

Beaumont, Frank Telford, Frank	To be placed in the First Class, instead of the Second Class, as previously announced.

GAS SUPPLY—ORDINARY GRADE.

Birmingham Technical School.

Hawthorn, S. K.	1st	Chemistry, Mechanics and Heat Engines, Prac. Maths., Machine Drawing.

ABSTRACT OF REPORT OF EXAMINERS IN GAS ENGINEERING AND GAS SUPPLY

Relating to the May Examinations of 1925.

INTERNAL EXAMINATIONS.

The numbers of candidates presenting themselves for examination were as follows:

Gas Engineering,	Higher Grade	13
,, ,,	Ordinary Grade	28
Gas Supply	Higher Grade	1
,, ,,	Ordinary Grade	5

Of these the number of candidates who satisfied the Assessors and Examiners in the two subjects was:

Gas Engineering,	Higher Grade	9.	All Second Class.
,, ,,	Ordinary Grade	3.	First Class, "With Distinction."
		5.	First Class.
		11.	Second Class.
Gas Supply	Higher Grade	0.	
,, ,,	Ordinary Grade	2.	1 First Class. 1 Second Class.

There was a considerable lack of uniformity in both the Engineering and Supply papers in the Ordinary Grade, both in the standard set in the different Technical Colleges and the time allowed for the examination. To redress the former, recourse was had to the powers invested in the Assessors as to excision, modification, and addition—powers which may have to be more extensively used if a similar variation occurs in the future. The time allotted to the examination in various centres ranged from 2½ to 4 hours; and this variation necessarily made a uniform assessment more difficult than it need have been.

Attention is also drawn to a general weakness in the simple sketches required for the illustration of answers. Many were rough, and few were of the character and standard which the Examiners expect from students. Considering the importance of correct sketching in the practical routine of the works and district, as well as in an examination paper, it is suggested that teachers might profitably pay rather more attention than hitherto to this in both class and home work.

EXTERNAL EXAMINATIONS.

Gas Engineering.

The number offering themselves for examination in the different grades was:

Diploma	7
Higher Grade	9
Ordinary Grade	30

Of these the successes were:

Diploma	6.	1 First Class. 5 Second Class.
Higher Grade	8.	All Second Class.
Ordinary Grade	20.	All Second Class.

With regard to the Diploma Examination, the standard of work was much higher than last year, as is strikingly seen in the large percentage of successful candidates.

In both the Higher and Ordinary Grades attention is again called to the inability on the part of the candidates to make quick and neat sketches. Some of the sketches were very good, but the majority were indifferent. All candidates—especially those sitting for the Higher Grade Examinations—should be able to make good sketches to illustrate their answers.

Attention is also called to the preference given by many candidates to the purely chemical questions. It is desirable that a proper balance should be maintained between the chemical and engineering aspects of gas engineering; and the Examiners will have this particularly in mind in future.

Gas Supply.

The number of examination papers submitted for marking was nine. Two of these were in the Higher Grade, and seven in the Ordinary Grade. The two candidates in the Higher Grade both failed. Of the seven Ordinary Grade candidates, the successes were as follows:

1 First Class (with Distinction).
3 First Class.
1 Second Class.

The number of students who sat for the examination is disappointing; but it is satisfactory to note that those who took the Ordinary Grade Examination in this section are well up to the standard required under the Education Scheme.

COLONIAL GAS ASSOCIATION, LTD.

The shareholders have been informed by Mr. C. Holmes Hunt, the London Secretary, that the following advice has been received by cable from the head office in Melbourne, respecting the operations of the Association during the year ended June 30 last:

The profit for the year, including the balance brought forward, and after providing depreciation and all taxes outstanding, amounts to £33,058. The Directors recommend payment of a dividend on the preference shares for the year at the rate of 8 p.ct. per annum (less interim dividend of 4 p.ct. paid for the half-year ended Dec. 31, 1924), and a dividend on the ordinary shares at the rate of 9 p.ct. per annum (less interim dividend of 4½ p.ct.); also that the sum of £4000 be added to the reserve fund and £4000 be set aside for Australian taxation on profits earned for the year. This will absorb the sum of £21,435, leaving £11,623 to be carried forward to next year's account.

The Directors' report refers to the satisfactory issue in March last of 63,647 8 p.ct. preference shares, and also states that a resolution will be submitted to the annual meeting for the creation of 45,000 additional 8 p.ct. preference shares and 25,000 additional ordinary shares. The report mentions that the shares and debentures of the Association are now quoted on the Melbourne, Sydney, and Adelaide Stock Exchanges, and refers to the reconstruction of the works at Footscray, including the installation of vertical retorts. It also mentions, with regret, the death of Mr. Henry Albert Underwood, a member of the Melbourne Board, and reports the appointment of Sir Arthur Robinson, K.C.M.G., to fill the vacancy.

The retiring Directors are Mr. P. C. Holmes Hunt and Sir Arthur Robinson, K.C.M.G., both of whom, being eligible, offer themselves for re-election.

The Auditors, Messrs. Sherlock & Daniell, also retire, and, being eligible, offer themselves for re-election.

Copies of the reports and accounts should reach the London office about the end of October, and will be immediately distributed to the shareholders.

For the first time for many years a gas exhibition was held last week in the Public Hall, Solihull.

The Bingley Urban District Council, last week, appointed a Sub-Committee to consider the provision of a joint gas and electricity showroom.

COLOMBO GAS AND WATER COMPANY, LTD.

An Extraordinary General Meeting of the Company was held on Sept. 22—Mr. S. C. CLARKE (Chairman) presiding. The following resolutions, which were passed at an extraordinary general meeting held on Sept. 7, were confirmed:

That each of the existing £10 ordinary shares and £10 preference shares of the Company be subdivided into ten shares of £1 each, and so that in the case of each such reduced share which is derived from an existing share the proportion between the amount (if any) which is paid and the amount (if any) which is unpaid thereon shall be the same as it was in the case of the existing share from which it is derived.

That the capital of the Company be increased from £85,000 to £125,000 by the creation of 40,000 additional ordinary shares of £1 each, ranking *pari passu* in all respects with the existing ordinary shares of the Company of £1 each resulting from the said subdivision.

The following resolution was also unanimously carried:

That it is desirable to capitalize the sum of £19,810, part of the undivided profits of the Company standing to the credit of the reserve account, and accordingly that the same be distributed among the members registered at the closing of the share register of the Company on Sept. 22 as holding the outstanding 59,430 ordinary shares of £1 each, resulting from the subdivision effected by the above resolution, in proportion to the said ordinary shares held by them respectively, free of income-tax, on the footing that the said sum be not paid in cash, but be applied in paying up in full 19,810 of the now existing unissued ordinary shares of £1 each; and that the Directors be authorized to distribute 19,810 of the said unissued ordinary shares, credited as fully paid, by means of the profits so capitalized, to and among the said members so registered as aforesaid so far as practical, in proportion to the number of the said outstanding ordinary shares held by them respectively—that is to say, in the proportion of one unissued ordinary share for every three outstanding ordinary shares so held.

The Halesowen Gas Company last week celebrated, by a dinner, the completion of the erection of a new gasholder, and extensions to the works.

LIGHTING STREET WORKS.

New Regulations in London.

Regulations designed to relieve the pressure on traffic in London streets have been made by the Minister of Transport on the recommendation of the London Traffic Advisory Committee. In the course of these, they provide for the lighting of street works.

It is provided that lamps showing red lights should be used generally within the London traffic area to indicate to pedestrians and drivers the extent of street obstructions. Importance is attached to uniformity of practice throughout the whole of the London traffic area in this matter; and the regulation provides that:

1. Temporary obstructions in the carriage-way should be lighted continuously between half-an-hour after sunset and half-an-hour before sunrise, or when necessary on account of fog.
2. Lamps should be placed at intervals of not more than 4 ft. measured at right angles to the line of traffic, and lamps showing the full length of the obstructions should be placed at intervals of not more than 12 ft. measured parallel to the line of traffic.
3. Where it is necessary to remove any light to allow traffic being worked through the part of the street which is obstructed, a person should be kept in attendance at the point or points of entry and (or) exit to remove and replace the lights and to warn traffic.

The regulations are intended to apply only to temporary obstructions in the carriage-way, and not to obstructions on the footpaths. Any person offending against the regulations will be liable to a fine not exceeding £5.

CONTRACTS OPEN.

Coal.

The Corporation of Birkenhead are inviting tenders for an eight months' supply of coal for gas-making purposes. [See advert. on p. 824.]

Water Gas Plant, Exhauster, Purifiers, &c.

The Gas Commissioners of the Burgh of Dunbar are inviting tenders for carburetted water gas plant, exhauster, purifiers, and retort house extension. [See advert. on p. 824.]

Condensers and Condensing Main.

The Corporation of Burnley are prepared to receive tenders for a steel condensing main and a vertical water-tube condenser for their Old Hall Gas-Works. [See advert. p. 824.]

EXTENSIONS.

Additional Plant at Oswaldtwistle.

A coke handling and breaking plant is to be installed at the Oswaldtwistle Gas-Works at a cost of £1800.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Sept.* 28.

A fair amount of business is reported in pitch, and the price is firmer at 40s. to 41s. 6d. net per ton.

Creosote also is maintaining firmness at 6¾d. to 6⅞d. net per gallon. Exports of creosote during August amounted to 2,538,000 gallons. The total exports for January/August this year were 30,398,441 gallons, as against 29,258,000 gallons over the corresponding period last year.

Tar spirits are in demand. Pure benzole and pure toluole are about 2s. 2d. net per gallon; 95/160 best solvent naphtha 1s. 9d. to 1s. 10d. net per gallon.

Tar Products in the Provinces.

Sept. 28.

The market for pitch generally has been firmer during the past week, and sales are reported at 40s. per ton f.o.b. on both East and West Coasts. It is difficult, however, to prove that any of these purchases were covered by sales to the Continent at equivalent prices, and it is possible that dealers have been covering on contracts made some time ago. The slight improvement in the market has had the effect of stopping the Continental demand for the time being.

Creosote oil is still steady, and there is a fair demand for home and export.

Solvent naphtha is not quite so firm, probably due to the fact that the cold weather is compelling the makers to remove more solvent naphtha from the benzole mixture which they sell for motor purposes.

Benzole is steady at prevailing prices for delivery to the end of the year.

There is little or no business doing in other products.

The average values for gas-works products during last week were: Gas-works coal-tar, 26s. 6d. to 31s. 6d. Pitch, East Coast, 39s. to 40s. f.o.b. West Coast—Manchester, 33s. 6d. to 34s. 6d.; Liverpool, 34s. 6d. to 35s. 6d. Clyde, 35s. to 38s. Benzole, 90 p.ct., North, 1s. 7½d. to 1s. 8½d.; crude, 65 p.ct., at 120° C., 1s. to 1s. 1d., naked at makers' works; 50-90 p.ct., naked, North, 1s. 7½d. to 1s. 8½d. Toluole, naked, North, 1s. 6½d. to 1s. 7½d., nominal. Coal-tar crude naphtha, in bulk, North, 7½d. to 8¼d. Solvent naphtha, naked, North, 1s. 4½d. to 1s. Heavy naphtha, North, 1s. to 1s. 2d. Creosote, in bulk, North, liquid, 5⅞d. to 5⅞d.; salty, 5⅝d. to 5¾d.; Scotland, 5½d. to 5¾d. Heavy oils, in bulk, North, 6½d. to 6⅝d. Carbolic acid, 1s. 4d. to 1s. 5d. prompt. Naphthalene, £11 to £14; salts, £4 to £5, bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

GAS REGULATION ACT, 1920.

BOYS' CALORIMETER

CALORIMETERS

PRESCRIBED BY

The Gas Referees

ARE

MANUFACTURED

:: PRINCIPALLY ::

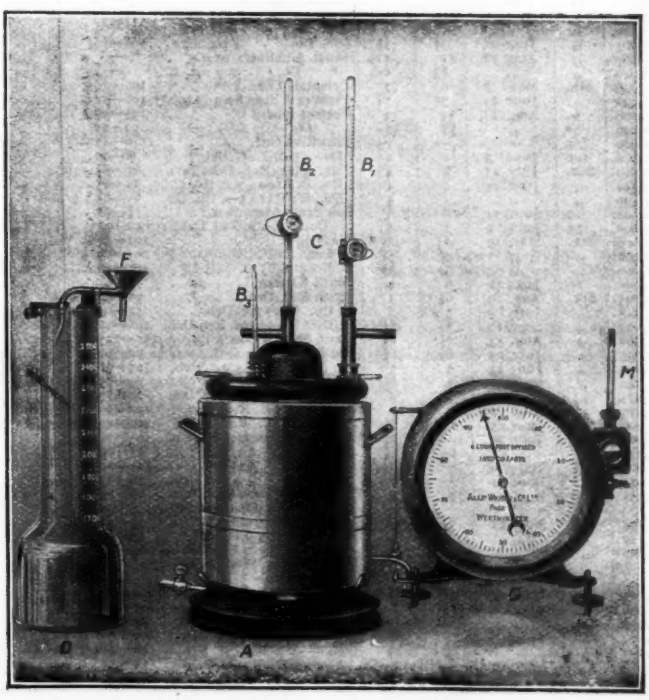
BY

ALEXANDER WRIGHT

& CO., LTD.,

1, WESTMINSTER PALACE GARDENS,

WESTMINSTER, S.W. 1.



STOCK MARKET REPORT.

WITH the exception of the activity in Rubber shares, the general tendency of the Stock Markets last week was dull and uninteresting. The announcement on Wednesday of the offer of £40,000,000 3½ p.ct. Conversion Loan at a minimum price of 76¼ caused a slight depression in Government issues, and, as money in New York became dearer, any hope of a reduction in the Bank Rate disappeared. Labour troubles continue to cause anxiety, and the position is not improved by the differences that have arisen over the interpretation of the temporary settlement with the miners. During the week gilt-edged stocks were inclined to ease; but War Fives kept steady at 102. Victory Bonds declined to 92 13/16, and Funding Loan to 89½. Foreign Bonds were also dull; Austrian Sixes and French Fives and Fours being weaker. Notwithstanding the rise in the milreis, some profit-taking in Brazilians, especially in New York, caused a slight fall in prices.

Industrials were no exception to the general rule, and dealers complained that they were compelled to purchase various shares to enable clients to speculate in Rubbers. The business done in this market was enormous, and there was an influx of jobbers from other markets. Practically all shares improved in price.

Business in the Gas Market was normal, with the exception that there was a big demand for Primitiva ordinary shares, and the price rose 1s. 9d. on the week to 11s. 6d.-12s. 6d. The only other change of importance was a rise of 5 points in the Brighton and Hove original stock to 166-171. An item of interest to gas investors is the offer by the Croydon Gas Company to consumers and employees of £100,000 5 p.ct. maximum dividend stock. The price is fixed at £4 5s. for each £5 of the stock, and the return is at the rate of £5 17s. 7d. p.ct.

The following transactions were recorded during the week:

On Monday, Bombay 19s. 6d., Brentford "B" 93, Brighton and Hove "A" 120½, 121, Commercial 3½ p.ct. 78, Continental Union 38⅛, 7 p.ct. preference 89, Croydon sliding-scale 100, Gas Light and Coke 80, 80½, 80⅝, 3½ p.ct. maximum 60¾, 60⅞, 4 p.ct. preference 77½, 3 p.ct. debenture 60, Imperial Continental 149½, 150, 150½, Liverpool 7 p.ct. preference 105½, Oriental 104, Primitiva 10s., 10s. 1½d., 10s. 3⅜d., South Metropolitan 90⅜, 91, 91¼, 91½, Tottenham "B" 85 5/16, 86½. Supplementary prices, Brighton and Hove 4 p.ct. debenture 76.

On Tuesday, Alliance and Dublin 65 5/16, 66, Brentford "B" 93⅜, Continental Union 37, 38⅛, 38⅞, 7 p.ct. preference 89, 90, Gas Light and Coke 80, 80⅛, 3½ p.ct. maximum 60, 60⅛, 3 p.ct. debenture 60, Montevideo 67, Primitiva 9s. 10½d., 10s., 10s. 1½d., 10s. 3d., South African 7¼, South Metropolitan 91⅜, Tottenham "B" 85. Supplementary prices, Gloucester consolidated 92, Southgate and District 5 p.ct. debenture 98, 98½.

On Wednesday, Alliance and Dublin 66⅞, Brentford "B" 93, Brighton and Hove original 169, 169½, British 109½, Cape Town 7¼, Gas Light and Coke 80, 4 p.ct. preference 78, 78½, Imperial Continental 151, Lea Bridge 5 p.ct. 96, 96½, Primitiva 10s. 1½d., 10s. 3d., 10s. 6d., 10s. 6⅜d., 10s. 7½d., 10s. 9d., 10s. 10½d., 11s., 11s. 3d., 4 p.ct. debentures 79½, 80. Supplementary prices, Southgate and District 7 p.ct. maximum 99½, 100, 5 p.ct. preference 80¼, 86½, 87.

On Thursday, British 108½, 109⅛, 109½, 109¾, Commercial 3½ p.ct. 78, Continental Union 37¼, 37½, 39¼, Gas Light and Coke 79⅜, 79½, 80, 80 1/16, 3½ p.ct. maximum 60⅜, 60⅝, 4 p.ct. preference 78, 78½, 3 p.ct. debenture 60, Imperial Continental 149½, 150½, Primitiva 10s. 6d., 10s. 9d., 11s. 0⅜d., 11s. 1½d., 11s. 6d., 11s. 9d., 11s. 10½d., 12s., 12s. 1½d., 12s. 6d., 4 p.ct. 1st debentures 80, South African 7⅛, 7¼, South Metropolitan 90½, 91, 91½, South Suburban 5 p.ct. 94¼, 95¼, 96, Southampton 81½, 82. Supplementary prices, Southgate and District 10 p.ct. maximum 137, 138.

On Friday, Brentford 5 p.ct. preference 95, 4 p.ct. debenture 78, British 109⅜, Cape Town 4½ p.ct. 1st mt. debenture 72, 72½, Gas Light and Coke 79½, 79⅝, 80, 3½ p.ct. maximum 60, Imperial Continental 150, Montevideo 69, Primitiva 11s. 6d., 11s. 7½d., 11s. 9d., 12s., 12s. 1½d., 12s. 3d., 12s. 4½d., 12s. 6d., South Metropolitan 90⅜, 91, 91¼, Tottenham "A" 107, "B" 86. Supplementary prices, Southend-on-Sea 5 p.ct. new 83, Wandsworth 5 p.ct. preference 90.

In Lombard Street there were plentiful supplies of loanable credit. New money was obtainable at 2⅜ p.ct., and at even lower rates. The average rate at which the Treasury Bills were allotted—£3 10s. 4·26d. p.ct., a rise of 3·11d. over that of the previous week—had a steadying effect on the discount market.

Business in the Foreign Exchange Market was on a small scale. Sterling on New York moved within narrow limits, closing at the end of the week at 4.84⅓. French and Belgian francs showed a trifling appreciation in each case, and closed at 102.32½ and 110.97½ respectively. Italian lire developed an easier tendency, the Milan rate rising 1 7/16 to 120¼.

Silver was unaltered at 32 1/16d. per oz., and Gold remained at the nominal price of 84s. 11½d. per oz.

The Bank Rate is 4½ p.ct., to which it was reduced from 5 p.ct. on Aug. 6. Bankers' deposit rates are 2½ p.ct. The deposit rates of the discount houses are 2½ p.ct. at call and 2⅝ p.ct. at notice.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Sept. 25.	Rise + or Fall − on Week.	Transactions Lowest and Highest Prices.
£			% p.a.	% p.a.				
171,978	Stk.	Aug. 13	5	5	Aldershot 5 p.c. max. C.	75—78	..	..
295,492	,,	,,	4	4	Do. 4 p.c. Pref.	69—74	..	..
1,351,868	,,	Apl. 2	6½	6½	Alliance & Dublin Ord.	63—68	..	65 5/16—66½
374,000	,,	July 9	4	4	Do. 4 p.c. Deb.	60—65	..	..
300,000	1	May 7	1/7½	1/7½	Bombay, Ltd.	¾—1	..	19/6
170,000	10	Aug. 13	8½	8½	Bournemouth 5 p.c.	12—13	..	..
425,030	10	,,	7	7	Do. B 7 p.c..	12—12½	..	..
150,000	10	,,	6	6	Do. Pref. 6 p.c..	11—12	..	..
50,000	Stk.	June 25	3	3	Do. 3 p.c. Deb..	56—59	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb..	77—80	..	..
992,045	,,	July 9	6 1/10	6 1/10	Brentford A Con.	93—98	..	..
990,500	,,	,,	6⅝	6½	Do. B New	93—98	..	93—93½
76,000	,,	,,	5	5	Do. 5 p.c. Pref.	94—97	..	95
306,690	,,	June 11	4	4	Do. 4 p.c. Deb.	75—80	..	78
181,337	,,	,,	6	6	Do. 6 p.c. Rich. Red. Deb.	100—105	..	..
214,740	,,	Aug. 27	12½	12	Brighton & Hove Orig.	166—171	+5	169—169½
244,200	,,	,,	9½	9	Do. A Ord.	119—122	..	120½—121
1,287,500	,,	July 23	5	5	Bristol 5 p.c. max.	89—91*a*	..	..
855,000	,,	Mar. 19	8	7	British Ord.	105—110	..	108½—109½
100,000	,,	June 25	7	7	Do. 7 p.c. Pref.	120—125	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	71—76	..	..
100,000	10	May 21	6	8	Cape Town, Ltd.	6¾—7¼	..	7¼
100,000	10	Apl. 23	4½	4½	Do. 4½ p.c. Pref.	5¼—6¼	..	..
150,000	Stk.	June 25	4½	4½	Do. 4½ p.c. Deb.	69—74	..	72—72½
626,860	,,	July 23	6	6	Cardiff Con. Ord.	98—101	..	..
237,860	,,	June 25	7½	7½	Do. 7½ p.c. Red. Deb.	101—104	..	..
157,150	,,	Aug. 13	6½	5	Chester 5 p.c. Ord.	90—95*b*	..	..
1,513,280	,,	July 23	5/14/8	5⅝	Commercial 4 p.c. Cap.	78—83	..	..
560,000	,,	,,	5⅝	5/3/4	Do. 3½ p.c. Cap.	78—83	..	78
475,000	,,	June 11	3	3	Do. 3 p.c. Deb.	56—59	..	..
800,000	,,	14 Jan. 15	—	—	Continental Union, Ltd.	35—40	..	37—39½
200,000	,,	June 11	7	7	Do. 7 p.c. Pref.	88—91	..	89—90
660,000	,,	Aug. 13	6½	6½	Croydon sliding scale	96—100	..	100
284,975	,,	,,	5	5	Do. max. div.	81—84	..	..
492,270	,,	Aug. 13	9	6	Derby Con.	107—109*c*	..	..
55,000	,,	June 25	4	4	Do. Deb.	74—76*c*	..	..
1,002,180	10	July 23	4	6	European, Ltd.	7—8	..	..
16,460,070	Stk	Aug. 13	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	79—81	..	79½—80½
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	60—63	..	60—60½
4,062,235	,,	,,	4	4	Do. 4 p.c. Con. Pref.	77—80	..	77½—78½
4,761,930	,,	June 11	3	3	Do. 3 p.c. Con. Deb.	58—61	..	60
130,000	,,	—	10	10	Do. 10 p.c. Bonds	..	..	..
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
82,500	,,	Mar. 19	6½	6½	Hastings & St. L. 5 p.c. Conv.	90—95	..	..
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	71—76	..	..
70,000	10	Sept. 24	10	10	Hongkong & China, Ltd.	17—18*	−½	..
86,600	Stk.	Aug. 13	10	10	Hornsey 7 p.c.	132—137	..	..
1,976,000	,,	May 21	10	59	Imperial Continental Cap.	148—151	..	149½—151
226,170	,,	Aug. 13	3½	3½	Do. 3½ p.c. Red. Deb.	70—71	..	..
235,242	,,	Aug. 13	6½	6½	Lea Bridge 5 p.c. Ord.	94—99	..	96—96½
2,127,340	,,	Aug. 13	5½	5½	Liverpool 5 p.c. Ord.	82½—83*b*	..	..
600,000	,,	Sept. 24	7	7	Do. 7 p.c. Red. Pref.	101½—103½*b*	−2½	105½
165,736	,,	Aug. 27	8	9	Maidstone 5 p.c. Cap.	118—128	..	..
63,480	,,	June 25	3	3	Do. 3 p.c. Deb.	55—60	..	..
75,000	5	June 25	3	7	Malta & Mediterranean	4—4½	..	..
541,920	Stk.	June 11	4	4	Montevideo, Ltd.	65—69	..	67—69
2,061,315	,,	Aug. 13	5	5	Newcastle & Gateshead Con.	71½—72*d*	+½	..
300,929	,,	,,	4	4	Do. 4 p.c. Pref.	75½—76½*d*	..	..
529,705	,,	June 25	3½	3½	Do. 3½ p.c. Deb.	68—68½	..	..
15,000	,,	Aug. 27	12	11½	North Middlesex 10 p.c.	—	..	..
75,940	,,	,,	8⅜	8 3/16	Do. 7 p.c.	—	..	..
300,000	Stk.	May 7	9	7	Oriental, Ltd.	100—105	..	104
188,120	,,	June 25	7¼	7½	Plym'th & Ston'house 5 p.c.	108—113	..	..
60,000	50	Aug. 27	14	14	Portsea Island B	93—96	..	..
100,000	50	,,	13	13	Do. C	90—93	..	..
2,289,909	1	—	—	—	Primitiva Ord.	11/6—12/6	+1/9	9/10½—12/6
302,600	100	June 2	4	4	Do. 4 p.c. Red. Deb.	78—80	..	79½—80
600,000	Stk.	July 23	4	4	Do. 4 p.c. Red. Deb. 1911	62—64	..	..
193,744	,,	June 25	4	4	Do. B. Aires 4 p.c. Rd. Db.	63—65	..	..
264,496	,,	,,	4	4	Do. R'r P'te 4 p.c. Rd. Db.	63—65	..	..
150,000	10	Sept. 24	6	6	San Paulo 6 p.c. Pref.	7½—8*	−½	..
125,000	50	July 1	5	5	Do. 5 p.c. Red. Deb.	42—45	..	..
270,000	Stk.	Mar. 19	5½	5½	Sheffield A	101—102*e*	..	..
419,968	,,	,,	5½	5½	Do. B	101—102*e*	..	..
1,047,000	,,	,,	5½	5½	Do. C	101—102*e*	..	..
90,000	10	June 11	6	4	South African	7—9	..	7½—7½
6,609,895	Stk.	Aug. 13	6½	5	South Met. Ord.	90—92	..	90½—91½
1,895,445	,,	July 9	3	3	Do. 3 p.c. Deb.	57—60	..	..
734,000	,,	Sept. 10	6½	6½	Do. 6½ p.c. Red. Deb.	101—103	..	..
91,500	,,	Aug. 13	8½	8½	South Shields Con.	132—133*d*	..	..
1,187,795	,,	July 23	6½	6½	South Suburban Ord. 5 p.c.	92—97	..	94½—96
368,837	,,	June 25	5	5	Do. 5 p.c. Deb.	95—98	..	..
647,740	,,	May 7	3	3	South'mpt'n Ord. 5 p.c. max.	80—83	..	81½—82
121,275	,,	June 25	4	4	Do. 4 p.c. Deb.	70—75	..	..
250,000	,,	Aug. 27	7	7	Swansea 7 p.c. Red. Pref.	100—102	..	..
200,000	,,	June 25	6½	6½	Do. 6½ p.c. Red. Deb.	101—103	..	..
120,000	,,	July 23	8	7½	Tottenham District A 5 p.c.	105—110	..	107
882,275	,,	,,	6½	5½	Do. B 3½ p.c.	85—90	..	85—86½
150,000	,,	July 9	—	28/4	Do. 3½ p.c. Pref.	103—105	..	..
181,255	,,	June 11	4	4	Do. 4 p.c. Deb.	76—79	..	..
258,251	,,	Aug. 27	5	5	Tynemouth Con. and New	73—75*d*	+1	..
					Uxbridge, Maidenhead, & Wycombe 5 p.c..	93—98	..	..
197,294	,,	Aug. 27	6½	6½	Do. 5 p.c. pref.	93—98	..	..
88,330	,,	,,	5	5	Do. 5 p.c. Maidenh'd	88—93	..	..
91,800	,,	,,	6½	6½	Wandsworth, Wimbledon, and Epsom—			
30,000	,,	July 9	9½	8½	Wandsworth A 5 p.c.	125—130	..	..
255,636	,,	,,	7½	7	Do. B 3½ p.c.	107—112	..	..
392,955	,,	,,	6/9/6	5/19/0	Do. C and New	93—96	..	..
352,000	,,	,,	7⅛	6½	Wimbledon 5 p.c.	100—105	..	..
98,000	,,	,,	7⅛	7⅛	Epsom 5 p.c..	109—112	..	..
88,416	,,	June 25	5	5	5 p.c. Deb.	56—59	..	..

Quotations at:—*a*,—Bristol, *b*,—Liverpool, *c*,—Nottingham, *d*,—Newcastle, *e*,—Sheffield; * Ex. div.

NORTH-EAST COAST COAL TRADE.

From our Own Correspondent.

The improved tone which had been noticeable in the previous week has been maintained, and there is certainly an increased volume of business, which is being felt, naturally, by the better-class collieries in the first instance. The better tendency has, perhaps, been helped somewhat by the new threats of trouble on the coal settlement, but the feeling generally in the market is that the movement will not receive a great deal of sympathy.

There is at present little movement in prices; but, with the considerably increased volume of inquiry that is now coming forward, sellers are less anxious to offer for forward positions at current rates. Against this, would-be buyers point to the fact that the amount of the subsidy will increase, and that, accordingly, colliery prices may tend to lower levels.

Wear Special and best quality Durham gas makes are steady, the former at 16s. 6d. to 17s., and the latter 16s. 6d. to 16s. 9d. f.o.b. Seconds are still plentiful at 13s. 3d. to 13s. 6d. Coking continues a very weak market; but even here there appears to be more inquiry lately, and it is felt that prices may soon begin to harden. At present, good qualities are obtainable round 13s. Durham bunkers are in fair demand, and best qualities are 14s. 6d. to 15s.

COAL TRADE IN THE MIDLANDS.

From our Local Correspondent.

A slight improvement is discernible in the distributive channels. It has not had much effect at the pits owing to the stocks that have to be absorbed before equilibrium is re-established. Employment has been relatively good in those districts which produce a large proportion of house coal, particularly those which supply the London market. Values have been easy with little quotable change. Where there was special pressure to sell, spot lots have been obtainable on terms much below the rates which collieries generally were prepared to recognize. In view of the half-yearly contracts there has been a good deal of discussion as to the price policy. While some collieries have thought the circumstances warrant the usual winter advance, there has been hesitation as to the course of action. That trading has been proceeding on very unsatisfactory lines is apparent to everybody. Nevertheless, the expediency of attempting to get higher prices for industrial coal is doubted by many whose interests make them favourable in principle to the objective. There are growing indications that emergency stocks which were put in by industrialists between two and three months ago are now being worked off. The rate of consumption has not increased appreciably, however, and the market disorganization is not overcome. Coke is easy.

YORKSHIRE AND LANCASHIRE COAL TRADE.

From our Local Correspondent.

There is rather more activity in the coal trade in Yorkshire and Lancashire this week. House coal is in better demand. Prices on the whole are steady, with indications of forward contracts at figures of about 1s. per ton advance. Industrial coals still move slowly.

Gas coals are in better request owing to the season, and the export market is better, with some inquiries from Germany. This has caused prices for hards, washed doubles, and washed smalls to be rather firmer than they were last week.

The following are the bunker and export prices at Hull (f.o.b. usual shipping ports): South Yorkshire.—Hards, Association, 18s. 9d. to 19s.; screened gas coal, 17s. 6d; washed trebles, 18s. to 18s. 6d.; washed doubles, 18s. to 18s. 6d.; washed singles, 15s. 9d. to 16s. 3d.; washed smalls, 13s. to 13s. 6d.; rough slack, 10s.; smithy peas, 15s. 6d. to 19s. 7d. West Yorkshire.—Hartleys, 16s. 6d. to 17s.; screened gas coal, 16s. 6d. to 17s.; washed trebles, 17s.; washed doubles, 16s. 6d.; washed singles, 15s. 6d. to 16s.; washed smalls, 12s.; unwashed trebles, 16s.; unwashed doubles, 13s. 6d.; rough slack, 10s. to 10s. 6d.; coking smalls, 10s. Derbyshire and Nottinghamshire.—Top hards, 19s. to 21s.; washed trebles, 17s. 6d. to 18s.; washed doubles, 17s.; washed singles, 16s.; washed smalls, 11s. 6d. to 12s.; rough slack, 9s. 6d. to 9s. 9d. Yorkshire, Derbyshire, and Nottinghamshire.—Screened steam coal, 15s. to 17s. 6d.; gas coke, 18s. 6d. to 23s.; furnace coke, 18s. to 19s. 6d. per ton.

Truro Gas Company.—At the annual meeting the Directors reported a net profit for the year of £2516—an increase of £400 on the previous year. It was decided to reduce the price for gas to consumers by 1d. per therm. The recommendation of the payment of a dividend of 5 p.ct. on the preference stock and 6 p.ct. on the ordinary stock was confirmed.

Maryborough Gas and Coke Company, Ltd.—After writing-off £450 for depreciation, transferring £206 to the reserve fund, and making provision for all other charges, the profit for the half-year ended June 30 amounted to £2443. The Directors recommended that this sum should be dealt with as follows: Payment of a dividend of 7 p.ct. per annum, £1443; reserve for renewals, contingencies, and taxation, £199; leaving a balance of £800 to be carried forward to meet overdue taxation.

Watford Gas Company's Co-Partnership.—The report of the Co-Partnership Committee of the Watford Gas and Coke Company for the year ended June 30 states that the bonus and interest paid by the Company again show an increase, and amount to £1165. The Committee purchased £2000 of "B" additional stock at the Company's sale in May last, and part of this has already been allotted to co-partners. The remainder will be disposed of as co-partners become eligible to receive amounts of £10.

Exhibition at Denbigh.—A four days' exhibition was opened at the County Hall, Denbigh, on Monday last, Sept. 28. This event, which has been organized by the Denbigh Gas and Coke Company, in co-operation with the Richmond Gas Stove and Meter Co., Ltd., has attracted great interest in the town. The practical cookery demonstrations each afternoon and evening have been specially well attended. Richmond's "Bungalow" and "Ranelagh" cookers are conspicuous features of a well-arranged exhibit, which includes a wide selection of equipment for heating, cooking, and water heating. A liberal scheme for the hire-purchase of apparatus has added much to the attractiveness of the whole project, while the offer of Richmond's "Elswick" cooker on free hire to users of slot meters is another progressive feature upon which the Denbigh undertaking are to be congratulated.

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Apply, stating Age, Wage required, with *copies* of References from previous employers, to No. 7597, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

APPOINTMENTS, &c., WANTED.

GAS Works Assistant desires progressive APPOINTMENT. Seven years' all-round Practical Experience of Installation of latest types of Plant, Gas Manufacture and Distribution, Laboratory Work, and Accustomed to Taking Complete Charge during Manager's Absence. Previously Works Chemist with firm of Tar Distillers. Age 26. Single. Unimpeachable Credentials.
Address, BOX 627, c/o "SMITH'S," 10, HIGH HOLBORN, W.C. 1.

CAPABLE young man (29) desires any Situation requiring Ability and Initiative. Secondary Education. Diploma in Chemistry, Royal Technical College, Glasgow. Practical Manipulative Experience—Bye-Product Coke Ovens (3 years), Horizontals and Water Gas (2 years). Some knowledge of Verticals and Specialized Experience of Bye-Product Recovery. 4½ years' active service.
For further Particulars and References, address No. 7594, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

PLANT, &c., FOR SALE & WANTED.

GAS PLANT IN STOCK.

GASHOLDERS & Steel Tanks. 18,000 and 10,000 c.ft.
Purifiers.—Dry lutes: Two 20 ft. by 14 ft., Two 10 ft. by 8 ft., One 10 ft. sq. Water lutes: Six 16 ft. sq., Four 8 ft. sq., Two 8 ft. sq., Two 8 ft. by 4 ft., One 10 ft. by 8½ ft.
Livesey Washers.—250,000 and 200,000 c.ft.
Tower Scrubbers.—4½ ft. by 36 ft., 4½ ft. by 18 ft., 4 ft. by 20 ft., &c.
Condensers.—Water cooled, 500,000 c.ft. per day. Two New Sets Blakeley's Baffle-Plate Condensers.
Exhausters.—2000 to 50,000 per hour capacities.
Sulphate of Ammonia Plant.—One ton per day.
Station Meters.—Capacities: 15,000, 8000, 5000, and 3000. Also 100, 200, and 300 lt. Meters.
Cart Weighbridge.—Suitable for Gas-Works, 12 by 6.
Station Governors.—4 in., 5 in., 6 in., and 8 in.
Storage Tanks.—All types and capacities.
Valves, Pumps, Engines, Cast and Rivetted Piping, &c.
Complete Detailed List on Application.
Firth Blakeley, Sons, & Co., Ltd.
(Second-hand Plant Dept.),
Vulcan Ironworks, Church-Fenton, Yorks.

GAS Plant for Sale—
Standard ROTARY Gas Works EXHAUSTER, direct coupled to Engine by Waller & Co., capable of dealing with 21,000 cubic feet of gas per hour at 50 in. water pressure.
Standard Gas Works TAR EXTRACTOR, Pelouze and Audouin type, to deal with half-a-million feet of gas per diem. Has been in use eight months.
5 H.P. CENTRIFUGAL PUMP and MOTOR.
BUCKET ELEVATOR, overall length 35 feet, capacity four to five tons per hour, with 5 H.P. Motor.
Standard Gas Works ROTARY EXHAUSTER by Byran Donkin and Co., capacity quarter million cubic feet per day.
Further particulars apply to: J. PARMLEY GRAHAM, SUN INSURANCE BUILDINGS, COLLINGWOOD STREET, NEWCASTLE-ON-TYNE.

STEAM-BOILERS For Sale—All Sizes Vertical, Loco-type, Cornish, Portable, and Other Types of Boilers.
Apply
GRANTHAM BOILER & CRANK CO., LTD., GRANTHAM.

WANTED, New or Second-hand, 20- Ton WEIGHBRIDGE with 18 ft. by 8 ft. Platform.
Full Particulars to No. 7595, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

REQUIRED—"National," Standard Type "M," 10 B.H.P. GAS-ENGINE, fitted Two Fly Wheels.
State Price, &c., to The ENGINEER, GAS WORKS, WEYMOUTH.

CONTRACTS OPEN.

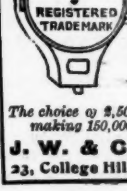
TO COLLIERY PROPRIETORS AND OTHERS

THE Corporation of Birkenhead are prepared to receive TENDERS for the Supply of SCREENED COAL, THROUGH AND THROUGH COAL, NUTS, and SLACK, for Gas Making Purposes for the period of Eight Months commencing from the 1st of November, 1925.
Forms of Tender, together with any further Information, may be obtained from the Gas Engineer, Gas Works, Birkenhead.
Tenders, stating the price per ton Delivered to the Gas-Works Railway Siding, as per Schedule embodied in Form of Tender, must be sent in to me, sealed and endorsed "Tender for Gas-Works Coal," not later than five o'clock in the afternoon of Thursday, the 8th day of October, 1925.
E. W. TAME,
Town Clerk.
Town Hall,
Birkenhead,
Sept. 21, 1925.

COUNTY BOROUGH OF BURNLEY.
(GAS DEPARTMENT.)
OLD HALL WORKS.

THE Corporation are prepared to receive TENDERS for the Supply, Delivery, and Erection of the following PLANT at the above works:
1 24-in. STEEL CONDENSING MAIN and Steel Supporting Trestles.
2 VERTICAL WATER TUBE CONDENSERS of 3 million c.ft. daily capacity.
Drawings, Specifications, and Forms of Tender may be obtained on Application to Mr. J. Herbert Clegg, F.C.S., Gas-Works, Burnley.
Sealed Tenders, appropriately endorsed and addressed to the Chairman of the Gas Committee, to be Delivered at the Gas Offices, Parker Lane, Burnley, on or before Oct. 13, 1925.
The Corporation do not bind themselves to accept the lowest or any Tender.
COLIN CAMPBELL,
Town Clerk.
Sept. 28, 1925.

BURGH OF DUNBAR.
(GAS DEPARTMENT.)
THE Gas Commissioners invite Tenders for the Supply and Erection of the undernoted PLANT at their Gas-Works.
CARBURETTED WATER GAS PLANT.
EXTENSION TO RETORT HOUSE.
EXHAUSTER.
PURIFIERS.
Specifications and further Information may be obtained on Application to Mr. Thomas O'Neill, Manager, Gas-Works, Dunbar.
Sealed Tenders, addressed to the undernoted and endorsed with the name of the Plant tendered for, to be Delivered on or before Oct. 9, 1925.
The Gas Commissioners do not bind themselves to accept the lowest or any Tender.
By order,
JOHN D. BROOKE,
Town Clerk.
Town Clerk's Office, Dunbar,
Sept. 28, 1925.



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